CHEMICAL EXPOSURE
OF
AIR FORCE MAINTENANCE WORKERS

Report of the Board of Inquiry
into
F-111 (Fuel Tank) Deseal/Reseal and Spray Seal Programs

Volume 2

The Findings – Terms of Reference Expressed, Explored and Discussed. Identification of the general details and personnel affected.

AUTHORISATION

The President and Members of the Board of Inquiry into the F-111 (fuel tank) Deseal/Reseal and Spray Seal Programs (1977-1999) confirm that we unanimously support the findings and recommendations presented in this report.

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29 June 2001

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CHAPTER 1 - RECOGNITION OF THE PROBLEM AND SUMMARY OF EVIDENCE

1.1. In late 1999, staff within the F-111 Fuel Tank Repair Section (FTRS) at No 501 Wing at RAAF Amberley became increasingly concerned with the chemicals they were using. They therefore acquired the latest Material Safety Data Sheets (MSDSs) on the fuel tank spray sealant and its primer[1]. The information contained in the MSDSs prompted a questioning of the personal protective equipment (PPE) provided, particularly the cartridge style respirators. The environmental health surveyor (ENVHSURV) from Health Services Flight was subsequently engaged to witness the next spray seal operation in February 2000 and he began his own research.

1.2. Shortly thereafter, the sergeant in charge of FTRS reported his symptoms to Dr Shumack at around the same time that FTRS members were attending for their annual health assessments. He was successful in getting Dr Schumack's attention that there was possibly a wider problem. By early to mid January 2000, about five others had presented to medical section. Dr Shumack referred some of these airmen to the psychiatrist for assessment and started to research the chemicals in use at FTRS privately. He did not at this point alert 501WG senior officers because the next spray seal aircraft was a month away and he was not yet convinced of the seriousness of the case. Ultimately, he consulted with the ENVHSURV and became aware of the unacceptable toluene break through time of the coveralls in use[2].

1.3. Coincidentally, Commanding Officer Aircraft Maintenance Squadron (CO AMSQN) spoke to the psychiatrist on 25 January 2000 on another matter and was informed incidentally of the FTRS airmen referred for assessment. Due to circumstances, he was unable to contact Dr Shumack until the morning of 28 January 2000 at which point he became sufficiently concerned to defer input of the next aircraft for spray seal until matters were resolved. CO AMSQN and Dr Shumack then reported separately to the Officer Commanding No 501 Wing (OC501WG) who immediately agreed to the decision to suspend spray seal activity[3].

Appointment of an Inquiry

1.4. On 4 February 2000, a formal investigation was convened by OC 501WG to identify FTRS people who might have been exposed to unsafe levels of chemicals, to determine the causes, extent and effect of exposure, and to re-establish safe fuel tank repair procedures.

1.5. The 501WG investigation related to the 'spray seal' procedure that had been introduced in 1996, and to subsequent maintenance work within tanks that had been spray sealed. Almost immediately however, speculation mounted on the effects on tradespeople of possible chemical exposure during all RAAF F-111 fuel tank repair programs, dating back to 1977. On 19 July 2000, the Chief of Air Force responded by appointing a Board of Inquiry (BOI) pursuant to Regulation 23 of the Defence (Inquiry) Regulations. The Board was required to conduct its Inquiry as much as possible in public. Because of the Board appointment, the terms of reference for the 501WG IO were necessarily amended, indeed suspended, and the 501WG task was confined to development of new fuel tank repair procedures. The terms of reference for the Board of Inquiry are at annex A to this Chapter.

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1 MAN.0015.001 (at 008), Witness Statement of Robert Leigh Mills at page 7 par 32.
2 EXP.0001.001 (at 006 and 007), Witness Statement Paul Henry Shumack at pages 6 and 7 par 23.
3 EXP.0001.001 (at 007), Witness Statement Paul Henry Shumack at page 7 par 24.

Interface Between 501WG IO and BOI - WGCDR Secker Report

1.6. Copies of the evidence collected by the 501WG IO were passed to the BOI at the request of Counsel Assisting the BOI and with the approval of the IO Appointing Authority (OC 501WG) on the condition that it not be attributed. With the appointment of the BOI, the primary objective of the IO had become the determination of how to safely perform general fuel tank maintenance on the F-111. The focus of his report is therefore on the actual maintenance practices now approved for use. In some cases, management issues are considered but mainly in the context of Defence's framework for developing safety procedures. The 501WG report was not bound by Defence Inquiry Regulations or the Defence Inquiries Manual. Some of the information obtained by the IO was presented in the management report to provide the reasons for changes in procedures. The final conclusions about past practices will not be drawn into the management report until after the BOI findings are published.

1.7. Overall, the Board found the 501WG IO's report to be extremely useful and broadly agreed with the recommendations. Board comment on the recommendations is included at annex B of this Chapter.

Interface Between DVA Health Study and BOI

1.8. DVA has contracted for an epidemiological study into the health of airmen employed on the F-111 deseal/reseal programs dating back to 1977. However, the results are some months and years away and hence could not be taken into account by this Inquiry. Some medical analysis, to the extent possible, is provided at Chapter 13 annex A.

Collection of Evidence

1.9. Over the course of the Inquiry, 646 people gave evidence in the form of affidavit (See annex C.) 47 people appeared before the Board to give evidence and most of these had also given statements (See annex D.) 1.5 million documents were researched as possibly containing information of relevance to the Inquiry. 40,000 documents were entered onto a database and presented as evidence. These documents contained 150,000 pages.

Summary of the Evidence by Reference to the Terms of Reference – General Details

3a(1) The chemicals used in the DR procedures….the chemical management systems and details of manufacturers and/or the suppliers of such chemicals.

1.10. Chapter 7 annex A sets out in detail the chemicals used in the programs. Some of the chemicals were common to all programs, notably MEK (a cleaner/solvent), and PR1750 (a sealant). All chemical products used were as specified from equivalent USAF procedures, hence products were specifically demanded. For the first deseal/reseal program the desealant SR51, its supplement SR51A and the detergent ED500 were acquired directly from El Dorado Chemical Company. The remainder of the chemicals on that program and all subsequent programs were acquired through the normal RAAF supply system. The first fuselage program was the only program to use chemical desealing methods. All of the chemicals were managed according to RAAF chemicals management policy, and all of the chemicals used had a material safety data sheet (MSDS) with manufacturers' instructions, although these were not necessarily as complete as required now, or available to those handling the chemical products. The SR51 desealant used on the first program, the MMS425 spray sealant primer and the PR2911 sprayable sealant appear to be unique to the F-111 from a RAAF perspective. The precise details are set out in Chapter 7.

3a(2) Whether or not the chemicals are toxic and, if so, the toxicity of the chemicals used in the DR procedures and their general effect upon personnel exposed to the chemicals and the extent of exposure necessary to have any adverse health effect.

1.11. A number of reports on this topic were commissioned by the Board and in turn these were summarised by Mr Stefan Danek from the Defence Science & Technology Organisation in his report recorded here at Chapter 7 annex C, and supported by his oral evidence given on 28 March this year.

In his evidence, Mr Danek identified a number of chemicals used in the D/R processes which were both toxic and which produced a significant health risk for ground crew who may have inhaled some of the chemicals, or absorbed them through their skin, either because no, or inadequate, PPE was worn. Mr Danek noted that the risks were significantly exacerbated, in relation to inhalation, in confined spaces such as fuel tanks. Mr Danek also indicated possible adverse health effects which ranged from:

a. the acute, such as irritation, respiratory distress, nausea and nervous disorder; to
b. the chronic, such as dermatitis and possible ulceration; and to
c. the systemic, such as serious effects on the liver, kidneys, respiratory, nervous or cardiovascular systems.

3a(3) All items of personal protective equipment used in the deseal/reseal procedures, the PPE management systems, the manufacturers and the suppliers of such PPE.

1.12. Chapter 8 annex A summarises the personal protective equipment (PPE) used in the spray seal and the second deseal/reseal program, and lists the suppliers in relation to the spray seal. For the earlier programs, it was more difficult comprehensively to identify all of the PPE used and often not possible to identify the manufacturers or suppliers. PPE became more completely specified, supplied and used over time and generally consisted of breathing protection by cartridge or air supplied respirator; skin protection by gloves, barrier cream, coveralls and booties; eye protection by goggles, face shield or full face respirator.

3a(4) The nature, extent and adequacy of work methods, instructions and training, including technical instructions provided by the manufacturers and/or suppliers relevant to the application of the chemicals used in the DR procedures together with the nature, extent and adequacy of instructions, instruments and orders provided by the RAAF, if any, concurrent with or further to the suppliers' and/or manufacturers' instructions from time to time.

1.13. The evidence on this topic has been analysed in two expert reports in particular, namely the report on the toxicology of deseal and reseal chemicals by Professor Connell and Dr Miller, and also in the report by Mr Danek. Broadly speaking, the extent and adequacy of instructions and technical instructions relevant to the application of chemicals in the DR process improved over time.

1.14. Certainly, it came to be understood that the chemicals used in the deseal/reseal and later the spray seal processes were considerably more toxic to those using them than had initially been thought. This later understanding is to be contrasted with, for example, the advice given to ground crew in relation to SR51 – the desealing fluid using in the first program. It appears that the material safety data sheet provided by the manufacturer of SR51 understated the toxicity of SR51 and understated considerably the need for PPE. The United States Air Force was more cautious in its approach to handling the SR51.

1.15. The Materials Research Laboratory (MRL) now the Defence Science & Technology Organisation (DSTO) was then asked to provide an opinion on the appropriateness of SR51 and, in this regard, the safety measures needed to be taken when in proximity to SR51 solution or its vapour. A senior scientist headed up the MRL task group in this regard. He provided a statement and gave oral evidence on 2 April to this Inquiry. His evidence was that, as a chemist, he was not giving an opinion on the appropriate PPE[4] but, nevertheless, he advised the Air Force to err on the side of caution and follow the USAF recommendation.

1.16. As already noted, over time the extent and adequacy of instructions provided by the manufacturers and suppliers of the chemicals urged greater and, in the light of subsequent scientific knowledge, more appropriate use of PPE. The RAAF did not add to those instructions, although, by the use of Australian Air Publications (AAPs), it adopted those instructions.

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[4] T384, Transcripts\Apr02.doc - PAUL 2 April 2001 at line 7.

3a(5) The nature, extent and adequacy of work methods, instructions and training, including technical instructions provided by the manufacturers and/or suppliers relevant to PPE used in the DR procedures, together with the nature, extent and adequacy of instructions, instruments and orders provided by the RAAF, if any, concurrent with or further to the suppliers' and/or manufacturers' instructions from time to time

1.17. Again, the RAAF did not supplement what was provided by the manufacturers in this regard. Furthermore, the PPE was generally not tailor-made for the specific work environment, so that the instructions were generic only. Very little has been discovered of ad hoc instructions from manufacturers or suppliers about the use of PPE and, similarly, very little has been discovered in relation to the involvement of manufacturers in work methods, instructions or training in the use of PPE specifically focused on the deseal/reseal processes. Essentially, the Air Force simply demanded items of PPE from suppliers without reference to the purpose to which the PPE was intended.

3a(6) The work methods and practices applied by personnel (ADF or otherwise) and training undertaken from time to time in executing the DR procedures

3a(8) All Defence instructions, instructions, instruments and orders with respect to the use of the chemicals and PPE in the DR procedures.

1.18. Generally speaking, the high level documents such as the Defence Instructions (Air Force) and the AAPs deal with what was to be achieved, whereas unit Standing Instructions and Bench Level Instructions described how the particular processes were to be performed – often attaching detailed work instructions. The hierarchy of instructions which led to the maintenance process specification and that governed safety considerations when using hazardous substances are listed at Chapter 9 annex A and Chapter 10 annex A respectively. These policies and instructions are relatively straightforward and not contentious. What may be debated, and this is dealt with later, is the extent to which required procedures were known, understood and followed, especially in relation to safety controls.

1.19. As far as training goes, there was a clear training requirement that personnel working on deseal/reseal operations were to be instructed as to the toxicity and pollution. After the conclusion of the first program, as late as 1986, manuals dealing with safe work in confined spaces were produced for the first time. Later still, a confined space entry course was introduced by the RAAF as a prerequisite for fuel tank repair work. This course now takes five days to complete.

3a(7) The occupational health and safety approvals, processes, management structures, procedures, training, equipment, personal protective equipment and workplace environment in force or implemented concerning the DR procedures from time to time, including any hazard identification, risk assessment and consideration of appropriate control measures.

1.20. The regulatory regime for safety management in the Australian Defence Organisation has progressed considerably in the period of concern to the Board. The current position is set out in Chapter 10 which makes reference to the statutory requirements of the *Occupational Health & Safety (Commonwealth Employment) Act*, the Australian Defence Organisation Safety Policy Manual known as "DOHSMAN" and the relevant Defence Instructions and lower level instructions designed to implement the ADO policy. Apart from these ADO specific requirements, there are a number of State regulations and relevant Australian Standards.

1.21. Turning from the regulatory framework to the OH&S management framework, this too has become more sophisticated over the years. Evidence in relation to this topic has been given by specialist staff from 501WG. What is notable about that evidence, is that personnel who were part of an OH & S structure were often unaware of their role in the structure, and the OH & S structure indeed often existed only on paper, with meetings not always being held as required, and co-ordination not occurring as required. Similarly, safety surveys and audits did not always operate as they should. This is a complex topic and is discussed more fully at Chapter 10.

3a(9) The Commonwealth compensation legislation that applied during relevant periods.

1.22. A summary of this legislation is given at Chapter 10 annex B. In support of this topic, on 10 April 2001, there was a helpful presentation by the Regular Defence Force Welfare Association (RDFWA), whose representatives then provided a brief summary of the various compensation schemes that might be applicable to RAAF personnel who worked on any of the programs. In essence, the statutes are: the *Compensation (Commonwealth Employees) Act*; the *Veterans' Entitlements Act*; the *Military Compensation Act*; and the *Safety, Rehabilitation & Compensation Act*. The *Safety, Rehabilitation & Compensation Act* also has an effect on any common law claims such as negligence claims which might be brought against the Commonwealth, although not claims which might be brought against third parties.

3a(10) The extent to which personnel (ADF or otherwise) performed their duties (supervisory or otherwise) in accordance with procedures and policies in force from time to time, concerning the DR procedures including, if applicable, the extent to which such personnel failed to perform their duties (supervisory or otherwise) and the reasons (if any) for such failure.

3a(13) Whether the performance or actions of any person (ADF or otherwise) whose performance or actions are directly related to the DR procedures might warrant further inquiry for administrative action.

1.23. Although there is some contest in the evidence between the technical work crews and their supervisors, there is little doubt that there was fairly widespread, usually inconsistent, non-compliance with procedures and policies required to be complied with, notably in the wearing of suitable personal protective equipment. The evidence is that, in all but a very few cases, no formal action was taken under the *Defence Force Discipline Act* or its predecessors against those involved. Such action now under the DFDA is, certainly for three out of the four programs, time-barred in any event. It is fair to say that nearly all of these non-compliances were due to lack of appreciation of the possible long term health consequences and/or PPE interfering with getting the job done rather than any wilful defiance.

1.24. The Board made it very clear at the outset that it did not wish to identify individual failings but rather systemic failings, and in those circumstances, and also given the rulings of the Board on the unsuccessful applications for possibly affected persons to be joined[5], it is not appropriate here to make individual findings of fault against any person.

1.25. There is, however, another aspect to this. There is considerable evidence that persons who failed to wear personal protective equipment were admonished verbally but not formally charged. One consequence of formally charging individuals for breaches of this type would have been to bring to the attention of senior officers at 3 Aircraft Depot and 501 Wing the extent of the problems caused by failure to wear personal protective equipment when handling and using toxic chemicals. The Board has explored this aspect reasonably thoroughly in Chapter 9 of Volume 1.

3a(11) The state of domestic and international medical and scientific knowledge from time to time concerning the hazards, health risks and best practice related to the chemicals and their use in the DR procedures.

1.26. The principal evidence on this topic is contained in the Envirotest Report - The State of Medical and Scientific Knowledge – Deseal/Reseal Chemicals F111 Fuel Tanks[6]. In summary, the knowledge of the extent of toxic effects or longer term risks from repeated exposures to the chemicals

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5 T13-15, Transcripts\Feb28.doc - BOARD, 28 February 2001.

6 EXP.0011.001, Professor Des Connell, Dr Greg Miller and Ms Shelley Anderson, *State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals F-111 Fuel Tank*, ENVIROTEST (November 2000).

used in the first deseal/reseal program was limited and inadequate and this may also have been the case in relation to the wings tank and second program.

1.27. By 1995, scientific and medical knowledge on the toxicity of almost all of the chemicals used in the forthcoming spray seal process had improved considerably. At the same time, there was by then a more general appreciation of the risk in the use of toxic chemicals and this found expression in national models of safety, and relevant State legislation for the control of hazardous substances.

1.28. Over the same period, health surveillance practices in the general community had developed. Unfortunately, however, there is little evidence to demonstrate a rigorous and appropriate occupational health monitoring program having been undertaken by the Air Force 'on the ground'. Indeed, there seemed to be a general recognition from all medical witnesses that, for at least the past decade, there has been no record-keeping system which has permitted trends in health across a group, such as the Fuel Tank Repair Section, to be monitored over time. It is understood that the Defence Health Organisation is developing such a system and this would seem to be urgently needed.

> **3a(12) Whether there were or are any systemic issues arising from … any matters identified which should be addressed by the RAAF or ADF.**

1.29. From very early in the Inquiry the Board identified and focussed on systemic failings governing OH&S matters. Indeed, this is very much the subject of Volume 1 of this report.

Summary of the Evidence by Reference to the Terms of Reference – Personnel Affected

> **3b(1) The identity of personnel who may have been exposed to chemicals used in the DR procedures and the details of their duties, including duration of those duties while so exposed.**

1.30. A list of all identified personnel, as comprehensive as the state of the evidence permits, is provided at Chapter 12 annex A. There are also a number of tables within Chapter 12 which seek to summarise in relation to each process and then each sub-aspect of the process, the details of the process and the individual duties of personnel in that process. Both RAAF members and contractor staff were employed at various stages across the four programs. Some of these were females. The main RAAF (and equivalent) trade used was Airframe Fitter (AFITT) for the first and wing programs, then Aircraft Technicians (ATECHs) following trade restructuring in 1992. They were supplemented by other trades from time to time; predominantly Engine Fitters and Motor Transport Fitters, this being especially so during the first program. Most of those whose employment clearly fits within the maintenance programs described in the Terms of Reference were identified and contacted/interviewed. Some who could be said to have been partially involved were included in the witness program, but many others with similar employment history to this latter group were not. Quite simply, there needed to be a limit set to the categories of witnesses, beyond which the work of the Inquiry was most unlikely to be enhanced.

1.31. The exact number of tradespeople and supervisors employed on the various stages of the deseal/reseal programs and on closely allied duties proved very difficult to determine because the workforce was quite fluid. During the course of the Inquiry, 710 people were identified as having been involved at the working level to some degree. Their names were determined from FTRS records, RAAF posting and attachment records, and contractor staff records in the first instance, and then as named by other witnesses. There is a high level of confidence that the list of those identified is all but complete.

> **3b(2) The nature and extent of health complaints reported as resulting from exposure to chemicals used in the DR procedures of those personnel identified above and the treatment provided, if there was any health monitoring of those personnel, details of preventative action taken as a result of health monitoring.**

1.32. There are a number of aspects to the evidence here. First, there was a report by Dr Dai Lewis[7], who examined the RAAF's health monitoring system over the period of the D/R programs. While he noted many positive matters, he found that much documentation appeared to be incomplete, that not all medical monitoring requirements appeared to have been followed, and that there had been little regular, multi-departmental reviews of the overall programs. There was also a lack of continuity and multi-disciplinary audit by the command and control structure. Dr Lewis, however, also noted that the recently promulgated F-111 fuel tank repair procedure health monitoring requirement met all Australian regulatory requirements and, in the main, exceeded best practice standards internationally.

1.33. An audit of medical documents was conducted by Dr Eric Donaldson, a medical aviation/occupational medicine expert. He examined the medical records for 110 of the 662 persons identified at that time as being possibly exposed to chemicals in any of the deseal/reseal programs, together with some additional information provided as a result of this inquiry. His full report is at annex A to Chapter 13 and the list of health complaints is at annex B to that same chapter.

1.34. With very rare exceptions, witnesses were amenable to being interviewed and to giving statements. A majority of the witnesses believe they have permanent medical condition/s as a consequence of their employment on deseal/reseal duties. Many of these report ailments which could be classed as tolerable, but many of those with more serious ailments have previously not been prepared to 'fight the bureaucracy' to prove their claim. A majority of witnesses nonetheless still generally enjoy good health.

3b(3) The nature and details of all claims for compensation arising from the DR procedures that have been received or notified.

1.35. A significant number of claims to COMCARE and DVA had been submitted and partially or fully accepted before the Board of Inquiry was convened. During the course of the Inquiry, further claims have been submitted but none of these has apparently been progressed to finality. A table describing the nature of the claims is included at Chapter 13 annex C.

[7] EXP.0004.001, Statement of Dr D Lewis; 17 Mar 01.

ANNEXES

Annex A – Terms of Reference

Annex B – The 501 WG Inquiry Officer’s Recommendations and Board Comment

Annex C – List of Witnesses by Category

Annex D – List of Witnesses who appeared before the Board

VARIATION TO
TERMS OF REFERENCE
FOR
THE BOARD OF INQUIRY INTO
THE F-111 DESEAL/RESEAL AND SPRAY SEAL PROGRAMS

1. Pursuant to the Appointment of 19 July 2000, The Board Of Inquiry Into The F-111 Deseal/Reseal And Spray Seal Programs (The Board) is to inquire into, make findings and recommendations concerning the following matters:

a. the Deseal/Reseal Program conducted by the RAAF and/or contractors in the late 1970's/early 1980's, upon F111 aircraft at 501 Wing Amberley (or its predecessors) ("the 1st Deseal/Reseal");

b. the Deseal/Reseal Program conducted by the RAAF and/or contractors in the late 1980's/ early 1990's upon F111 aircraft at 501 Wing Amberley (and its predecessors) ("the 2nd Deseal/Reseal");

c. the post 1996 Spray Seal conducted by the RAAF and/or contractors upon F111 aircraft at 501 Wing Amberley (or its predecessors) ("the Spray Seal"); and

d. the wing tank Deseal/Reseal conducted from the late 1980's/ early 1990's by the RAAF and/or contractors upon F111 aircraft at 501 Wing Amberley (or its predecessors) ("the wing tank DR Procedures")

(each of the 1st Deseal/Reseal, 2nd Deseal/Reseal, the Spray Seal and the wing tank DR Procedures being collectively referred to as "the DR procedures").

2. The Board is to take into evidence the reports of the Investigating Officer appointed on 31 January 2000 "to investigate and report upon the F111 fuselage fuel tank spray sealing" (the Deseal/Reseal Investigation) as amended and the report of an Investigating Officer, if appointed, upon "A Health Study of personnel involved in the maintenance of RAAF F-111 Fuel Tanks" and to consider those reports.

3. As to the DR procedures, the Board is to identify, investigate and report on the following:

a. General Details

(1) each of the chemicals used in the DR procedures (the chemicals), the chemical management systems and details of manufacturers and/or the suppliers of such chemicals;

(2) whether or not the chemicals are toxic, and if so, the toxicity of the chemicals used in the DR procedures and their general effect upon personnel exposed to the chemicals and the extent of exposure necessary to have any adverse health effect;

(3) all items of personal protective equipment ("PPE") provided and used in the DR procedures, the PPE management systems, the manufacturers and the suppliers of such PPE;

(4) the nature, extent and adequacy of work methods, instructions, and training including technical instructions provided by the manufacturers and/or suppliers relevant to the application of the chemicals used in the DR procedures together with the nature, extent and adequacy of instructions, instruments and orders provided by the RAAF, if any, concurrent with or further to the suppliers' and or manufacturers' instructions from time to time;

(5) the nature, extent and adequacy of work methods, instructions, and training including technical instructions provided by the manufacturers and /or suppliers relevant to PPE used in the DR procedures together with the nature, extent and adequacy of instructions, instruments and orders provided by the RAAF, if any, concurrent with or further to the suppliers' and or manufacturers' instructions from time to time;

(6) the work methods and practices applied by personnel (ADF or otherwise) and training undertaken from time to time in executing the DR procedures;

(7) the Occupational Health and Safety approvals, processes, management structures, procedures, training, equipment, personal protective equipment (PPE) and workplace environment in force or implemented concerning the DR procedures from time to time including any hazard identification, risk assessment and consideration of appropriate control measures;

(8) all Defence Instructions, instructions, instruments and orders with respect to the use of the chemicals and PPE in the DR procedures;

(9) the Commonwealth compensation legislation that applied during relevant periods;

(10) the extent to which personnel (ADF or otherwise) performed their duties (supervisory or otherwise) in accordance with procedures and policies in force from time to time, concerning the DR procedures including, if applicable, the extent to which such personnel failed to perform their duties (supervisory or otherwise) and the reasons (if any) for such failure;

(11) the state of domestic and international medical and scientific knowledge available from time to time concerning the hazards, health risks and best practice related to the chemicals and their use in the DR procedures;

(12) whether there were or are any systemic issues arising from any matters identified which should be addressed by the RAAF or ADF; and

(13) whether the performance or actions of any person (ADF or otherwise) whose performance or actions are directly related to the DR procedures might warrant further inquiry for administrative action.

b. Personnel Affected

(1) the identity of personnel who may have been exposed to chemicals used in the DR procedures and the details of their duties, including duration of those duties, while so exposed.; personnel includes ADF and ADF contracted labour, personnel directly involved in DR procedures, ADF personnel working in such proximity to the chemicals used in the DR procedures as to be at risk of adverse health effects and next of kin of those ADF and ADF contracted labour personnel directly involved in DR procedures; and

(2) the nature and extent of health complaints reported as resulting from exposure to chemicals used in the DR procedures of those personnel identified above and the treatment provided; if there was any health monitoring of these personnel, detail of any preventative action taken as a result of health monitoring; and

(3) the nature and details of all claims for compensation arising from the DR procedures that have been received or notified.

4. The Board is to make recommendations as follows:

a. Primary Recommendations

(1) what action, if any, should be taken to prevent a recurrence of the incidence of adverse effect, if any, upon ADF and contractor personnel associated with the application of the chemicals in the DR procedures; and

(2) whether any matters warrant further investigation.

b. Secondary Recommendations

(1) what action, if any, should be taken to eliminate the inadequacies of any service, equipment, chemicals, procedure, training, orders, instructions and publications revealed in the course of the inquiry which are not regarded as causal factors per se but which the Board considers should be subject to action by the Appointing Authority; and

(2) whether any environmental matters arising should be referred to any appropriate authority for its examination.

AIR MARSHAL ERROL JOHN McCORMACK, AO
CHIEF OF AIR FORCE

APPOINTING AUTHORITY
Original Instrument: 19 July 2000
First Instrument Variation: 27 February 2001

Terms of Reference Varied: 15 May 2001

THE 501WG INQUIRY OFFICER'S RECOMMENDATIONS AND BOARD COMMENT

R1: The IO's report be forwarded to the Deseal/Reseal BOI for consideration.

Board Comment: The IO's report has been taken in to evidence as required by theTerms of Reference.

Health Assessments

R2: The short and long-term effects of exposure to solvents be reviewed by DGDHS.

Board Comment: Agree. The Board notes that Material Safety Data Sheets are available from the Chemwatch database and that these contain advice on possible health effects and appropriate precautions to be adopted. The DGDHS review should look to validate this health effect advice for common solvents used by the ADO. The Board notes further that DSMA issued Hazard Alert 02/00 relating to MEK and toluene.

R3: If necessary, as a result of the Recommendation 2 review, DGDHS develop a health management program for FTRT personnel who reported symptoms consistent with exposure to solvents.

Board Comment: The Board expects that the directive issued by CAF, as part of his five point plan, that 'Air Force is committed to ensuring that adequate health services are available for any workers who may have been affected by past Deseal/Reseal practices' will have been implemented. DGDHS should consider the need to reinforce to Health Sections that possible exposure to chemicals should be considered if patients who use hazardous chemicals in their duties present with a representative range of symptoms and to consider routine surveillance as a means managing cases when appropriate.

Management Framework

R4: The use of the words safety and safe in the ADO be clarified, particularly in relation to occupational safety.

R5: A corporate occupational safety management framework be developed and implemented in the ADO to support commanders in fulfilling their responsibilities for the occupational safety of their aircraft maintenance personnel.

R6: An Occupational Safety Centre of Expertise be established in the ADO to support, as a minimum, the development of maintenance safety practices.

R7: Responsibility for specification of occupational safety requirements in the acquisition process be identified and promulgated.

R8: AS/NZS 4804, Occupational Health and Safety Management Systems – Principles, Systems and Supporting Techniques be implemented at the corporate level in the ADO.

R9: Responsibility for identifying, developing, communicating and maintaining occupational safety standards in the ADO be assigned and promulgated.

R10: Responsibility for identifying, developing, communicating and maintaining authorative occupational safety data for use in the ADO be assigned and promulgated.

R11: Competencies be prescribed for appointments responsible for providing occupational safety advice and support to commanders.

Board Comment R4-R11: The Board agrees with the general inference drawn from these recommendations that the ADO OH&S management framework at the time of appointment of the BOI was inadequate for ADO purposes. The Board notes that a number of initiatives have been taken to in part redress these inadequacies; the formation of the Air Force Ground Safety Agency being one example. These steps notwithstanding, the Board has addressed management framework issues in its report and made recommendations accordingly. Recognising the AS 4804 guidelines is one aspect of the Board's recommendations, as is applying the discipline of AS9001 to designing safety solutions.

Occupational Safety Requirements

R12: The Energy Trace Checklist (ETC) modified by the Human Factors Analysis (HFA) be adopted as the standard technique and tool for hazard identification.

R13: Supporting infrastructure including policy, training and documentation be put in place to support the modified EFC technique.

Board Comment R12-R13: The Board accepts the premise that there is insufficient rigour in the hazard assessment and analysis guidance given to RAAF workplaces by DIs(AF) PERS 56-15 and PERS 60-3, especially hazardous maintenance environments. Whether the ETC and HFA are the most appropriate tools to redress this is another matter. Nevertheless, the Board respects the judgment of the IO in using these tools to develop safe fuel tank entry and repair processes for the F-111. The Board notes guidelines such as AS/NZS 3931 – Risk Analysis of Technological Systems – Application Guide, AS/NZS 4360 – Risk Management, and MIL STD 882 (US) Standard Practice for System Safety might also have relevance but accepts that they, too, are probably insufficiently discerning to have been of particular use in identifying spray seal hazards. DSMA should improve the guidance given to units for the identification and analysis of hazards in industrial like workplaces, and for subsequent risk analysis and response. To this end, the Failure Mode Effect and Criticality Analysis (FMECA) detailed in AAP 7001.038-1 with respect to aircraft maintenance may be a useful start, although again this analysis would also appear to have its limitations with respect to the more hazardous environments. As a guiding principle, Australian Standards should be adopted by preference.

R14: Identification of the sources of risk (hazards) to the health of maintenance personnel be integrated (by DAIRMAINT) into the processes for developing aircraft maintenance processes.

Board Comment: Agree. The person requiring an action to be done should be responsible for ensuring that action can be done safely. Therefore, maintenance process design and specification should require OH&S issues to be addressed as an integral part of the process specification. This initiating responsibility is better addressed to DAIRENG for policy and CENGRs to apply. DAIRENG may require DSMA advice on appropriate wording for the OH&S issues and processes. The CO who then requires the maintenance process to be applied is responsible for safe application of the approved process. DAIRMAINT is responsible for policy that guides maintenance practices, hence should also be responsible for policies which govern audit and review of maintenance practices.

R15: That occupational safety issues be addressed by personnel competent in occupational safety.

Board Comment: Agree, although this is something of a motherhood statement. DSMA needs to identify and promulgate specific OH&S competency and assessment requirements either by knowledge, skills and attitude (KSA per CDRTRG guidance), or qualifications, training and experience (QTE) per DGTA guidance).

R16: Development of occupational safety solutions be transparent to provide traceability between external and internal requirements and the occupational safety solution implemented.

Board Comment: Agree. However, the responsibility should lie with the CENGR in the aircraft maintenance process context and recorded as part of the design record, not DSMA as indicated by the IO.

R17: DOHSMAN, OHSMAN1 and the Safety Manual be audited against statutory regulations and codes of practice to ensure they are current and complete.

Board Comment: The Board is of the view that a fair deal of confusion is created by the current haphazard mix of policy and procedure in Defence Instructions (General) and (Air Force) on the one hand, and in DOHSMAN on the other. Further doubt is introduced by the the continuing currency of OHSMAN1. The Board's understanding is that DSMA intends publishing a Safety Policy Manual (SAFETYMAN) which is to supersede and/or overarch all current Defence safety publications. This intent is appropriate, however, it should be preceded by the recommended audit and the rationalisation and simplification of the content of current DIs, DOHSMAN and OHSMAN1. The flying safety high level policy as promulgated in DI(G) OPS 28-2/DI(AF) OPS 6-1 and the procedural Flying Safety Manual are fair guides to appropriate balance. As well, reference to Australian Standards alone, as is the case with many DOHSMAN instructions, is inadequate; some guidance needs to be given on how AS are to be applied in the Defence environment. Finally, policy should be confined to Defence Instructions and procedures to the SAFETYMAN

R18: Standards be developed or adopted for those hazards that are not covered in the DOHSMAN (eg psychological).

Board Comment: This recommendation would seem self evident. However, depending on the intent, the example may be a poor one as this aspect would be better addressed by health policy for when medical staff specify and conduct occupational health assessments (both at job and trade levels).

Gathering Safety Data

R19: A Defence Agency be assigned the responsibility to monitor new knowledge in relation to jet fuel exposure and be equipped with the capability to do so.

Board Comment: The Board is not in a position to comment on this particular recommendation other than to make the observation that monitoring research and trends internationally within the safety and health professions, by Defence staffs, should be an extant responsibility.

Past Safety Practices

R20: That F-111 fuel tank maintenance personnel be trained in the use of hazardous substances.

Board Comment: The Board notes that this is a standing responsibility of COs as detailed by DI(AF) PERS 56-15 paragraph 36 (while noting that this instruction is dated, apparently superseded by DI(AF) PERS 60-3 and can be easily overlooked as the requirement is not clear from DOHSMAN). There is also a need to review, with a view to amending, DI(AF) LOG 3-112 - Management of the Performance of Technical

Equipment Maintenance, Annex A, to include Hazardous Chemicals and Confined Spaces as maintenance processes that attract mandatory training requirements.

R21: Occupational safety procedures be integrated into work practices to avoid fragmentation of information and increase the accessibility to safety information.

Board Comment: Agree. See also comments against R14.

R22: F-111 fuel tank maintenance personnel be educated on heat stress, including the effects of dehydration, and ways to minimise the effects.

Board Comment: Agree. This aspect should be inclusive to the requirement commented on against R20 and, if serious, by limitation of duty times in the prescribed safety solution developed per R14.

R23: Further investigation be conducted into the systemic, management, support and medical issues associated with fuel tank maintenance and the symptoms reported by FTRT.

Board Comment: This is the purpose of the Board of Inquiry.

R24: Occupational safety procedures focus on work environments and the integration of hazard management strategies rather than individual hazards in isolation.

Board Comment: Agree.

R25: Greater emphasis be given to the quality of F-111 fuel tank maintenance activities to minimise the need for personnel to enter tanks.

Board Comment: Agree.

R26: Greater emphasis be given to the higher order hazard controls such as engineering controls, particularly ventilation.

Board Comment: Strongly agree. More to the point, relying on PPE to minimise risk is fraught with danger; PPE is the second last line of defence in front of health surveillance and has proven to be an unforgiving insurance. There is ample evidence that PPE readily lulls people into a false sense of security. Having occupational safety measures as an integral component of the overall technical process approval should better promote the heirarchy of controls. Focus should be as much on reducing consequences as on reducing the hazard. This aspect is addressed in full at Volume 1 Chapter 7 of the BOI report.

R27: F-111 fuel tank maintenance personnel be given training on the correct use, operation and maintenance of breathing air systems.

Board Comment: Agree. Comment as per R20 applies. Training should adopt the provisions of AS/NZS 1715 – Selection, Use and Maintenance of Respiratory Protective Devices.

R28: Health surveillance be an integral component of the occupational safety solution for fuel tank maintenance.

Board Comment: Agree, with qualification. Health surveillance, or occupational health assessment, should be an active consideration whenever PPE is mandated or worn regularly on the job. The appropriate assessment may be site specific, as with FTRS personnel, or may be trade specific, as with SURFINs. DGDHS should review aircraft fuel tank entry generally to determine if OHA is necessary after a period of working in confined spaces with the potential for exposure to AVTUR and solvents.

R29: Development of new procedures take into account the specific deficiencies identified during the investigation into past practices.

Board Comment: This would appear to have been achieved with the issue of new F-111 fuel tank repair procedures. This is addressed more fully in Volume 1 Chapter 10 of the BOI report

Occupational Safety Solution Design Development and Certification

R30: Risk management policies, methodologies, training and tools, in particular the Risk Score Calculator, be reviewed to ensure consistency in application and use of terminology.

Board Comment: Agree. Comments against R12 are relevant here also. The risk score calulator on the DSMA web site is very subjective and thus very much open to manipulation, especially if used by the poorly informed.

R31: Training for F-111 fuel tank maintenance personnel be reviewed using the lessons learned in the IO's report.

Board Comment: See comments against R20.

R32: New procedures for F-111 fuel tank maintenance be analysed to determine implications for other areas of Defence.

Board Comment: Agree. See also comments against R29 and, more generally, Volume 1 Appendix 6 of the BOI report.

R33: The reduced exposure standard for fuel be published as a matter of urgency.

Board Comment: The Board notes that there is inconsistency between the exposure standard to AVTUR as promulgated in various MSDS and the most recent advice from DSMA to the IO. This inconsistency needs to be resolved.

R34: Monitoring equipment be purchased that enables fuel vapour to be monitored real time at the new exposure standard level (concentrations of 14ppm and below).

Board Comment: This is highly desirable. If such equipment is not available, the consequence is that full PPE is required to be worn in all cases.

R35: Employment of females in occupations that are exposed to fuel and solvents be reviewed to ensure that adequate safety measures are in place.

Board Comment: Without being in a position to endorse the step taken by SRLMSQN to exclude females from working in F-111 fuel tanks, the Board recommends DGDHS review the data and advice gathered by the IO that is relevant to this issue. DGDHS then needs to promulgate minimum health safe standards. COs are subsequently at liberty to impose more conservative standards as situations allow to reduce risk and consequence further.

Design Acceptance and Implementation

R36: Policy address all areas of the regulations and if regulations are not applicable then the policy should reflect this.

Board Comment: Agree.

R37: Policy in relation to Defence's responsibilities as a manufacturer or supplier of hazardous chemicals should be reviewed particularly in relation to chemical waste.

> **Board Comment:** The Board is unclear on instances where Defence is a manufacturer or supplier of hazardous chemicals under the Occupational Health and Safety (Commonwealth Employment) Act 1991 section 18. Further, no evidence was received on inappropriate disposal of chemical waste relating to the spray seal program.

R38: Audit of policy against regulations pay particular attention to:

- MSDS
- Labelling of containers
- Hazardous substance registers, and
- Promulgation of substances that are prohibited for use.

> **Board Comment:** The IO's judgment is accepted. There is evidence of inadequate compliance with hazardous substance registers, at least.

R39: Workstands be audited for compliance with standards (AS/NZS 1657-1992 – Fixed platforms, Walkways, Stairways and Ladders – Design, Construction and Installation).

> **Board Comment:** This aspect was not within the Terms of Reference for the BOI.

R40: Hazardous substance management training courses, addressing all aspects of managing and working with hazardous substances, including psychological issues and safety practices be developed and provided to fuel tank maintenance personnel.

> **Board Comment:** Agree.

R41: F-111 fuel tank leak repair training course addressing all aspects of the use of aerospace sealants, including storage, mixing, application (especially in difficult environments such as a fuel tank), curing, and disposal be developed and provided to fuel tank repair personnel.

> **Board Comment:** Agree. See also comments against R20.

R42: Greater emphasis be given to the management of psychological stresses in fuel tank maintenance, including development of standards for publication in the DOHSMAN.

> **Board Comment:** Agree. However, this should be a DGDHS responsibility when evaluating the need for OHAs rather than promulgated as a standard in DOHSMAN. See comment at R18.

R43: Confined Space Entry (CSE) training packages include formal instruction on the prevention of dehydration and the effects of heat stress.

> **Board Comment:** Agree, with diminished emphasis. The OHA contribution to an approved maintenance process should identify safe duty periods. See Board recommendation10.7.

Lessons Learned

R44: Defence establish a capability, including systems, processes, methodologies, tools and trained personnel, to investigate significant occupational safety incidents in the field of aviation safety maintenance.

Board Comment: The Board notes that this recommended activity is principally the jurisdiction of COMCARE and expects results should be managed as suggested by comment against R29. The Board agrees though that an independent investigation capability is necessary to address many of the myriad of incidents which may not be investigated by COMCARE.

R45: Defence establish a standing offer or panel contract of occupational safety specialists to assist in investigations and the development of occupational safety solutions.

Board Comment: Agree. It will usually be the case that Defence is unable to sustain particular competencies to support this intent.

LIST OF WITNESSES BY CATEGORY

EXPERTS

FAMILY NAME	GIVEN NAMES	CATEGORY
BROMWICH	DAVID	EXPERT
COOKSLEY	WILLIAM	EXPERT
DANEK	STEFAN K	EXPERT
DONALDSON	ERIC	EXPERT
FOSTER	KEVIN	EXPERT
LEWIS	DAI	EXPERT
McDONALD	GEOFF	EXPERT
MEREDITH	LESLIE	EXPERT
MILLER	DR GREGORY JOHN	EXPERT
ROSS	DR JAMES	EXPERT
SECKER	STEVE	EXPERT
TIERNAN	JAMES FRANCIS GERARD	EXPERT
TURNER	KIMBERLEY	EXPERT

MANAGEMENT

FAMILY NAME	GIVEN NAMES	CATEGORY
AESCHLIMAN	CHRISTOPHER HENRY	MANAGEMENT
BARLOW	COLIN EDWARD	MANAGEMENT
BATES	GARRY FREEMANTLE	MANAGEMENT
BEIGHTON	PAUL	MANAGEMENT
BIRD	HARRY RAYMOND	MANAGEMENT
BIRT	PETER TOMAS	MANAGEMENT
BRAGG	EDWIN KENNETT	MANAGEMENT
BRENNAN	MAXWELL JAMES	MANAGEMENT
CLIFFORD	ARTHUR WINNETT	MANAGEMENT
COLLIER-BAKER	ALAN	MANAGEMENT
CULL	GARY JOHN	MANAGEMENT
DEDERER	GEORGE MAXWELL	MANAGEMENT
DOHERTY	DESMOND ROBERT	MANAGEMENT
DORNEY	SASHA	MANAGEMENT
DUFF	DAVID JOHN	MANAGEMENT
DUGDALE	MICHAEL ROBIN	MANAGEMENT
FELLOWES	GEOFFREY EDWARD	MANAGEMENT
FOWLER	P	MANAGEMENT
GLEESON	MICHAEL	MANAGEMENT
GOON	PETER ANTHONY	MANAGEMENT
GORDON	VINCENT PAUL	MANAGEMENT
GREENWOOD	CHRISTOPHER ROBERT	MANAGEMENT
HARREX	WARREN KEITH	MANAGEMENT
HEWISON	MARK LLEWELLYN	MANAGEMENT
HIBBETT	DANNY	MANAGEMENT
HOMER	GEORGE HENRY	MANAGEMENT
JAMIESON	IAN GEOFFREY	MANAGEMENT
KAYE	LINDA	MANAGEMENT
KEMBLE	ADRIAN JOHN	MANAGEMENT
LANG	LESLIE JAMES	MANAGEMENT
LANG	SAMUEL BRAMBLEY	MANAGEMENT
LAWSON	ROBERT NOEL	MANAGEMENT
MACCARONE	JOHN	MANAGEMENT

MCDOUGAL	MERVYN JAMES	MANAGEMENT
MCKINNIE	ANDREW	MANAGEMENT
MELOR	K	MANAGEMENT
MIDDLETON	NEVILLE PHILIP	MANAGEMENT
MINTO	MARK CAMERON	MANAGEMENT
MORRISON	ADRIAN SCOTT	MANAGEMENT
MORRISSY	WILLIAM FRANCIS	MANAGEMENT
MOYLAN	DAVID JOHN	MANAGEMENT
NEWMAN	DANIEL MICHAEL	MANAGEMENT
NOBLE	MICHAEL LESLIE	MANAGEMENT
O'DONOGHUE	MICHAEL JOHN	MANAGEMENT
OLIVER	CYRIL ERNEST	MANAGEMENT
PAUL	DAVID BRENTON	MANAGEMENT
PETERSON	JULIE ANN	MANAGEMENT
ROBERTS	GARY	MANAGEMENT
ROBERTSON	ANDREW GEOFFREY	MANAGEMENT
ROBERTSON	ANDREW REGINALD	MANAGEMENT
ROWE	JOHN MICHAEL	MANAGEMENT
SARGEANT	BRENDAN JOHN	MANAGEMENT
SARGEANT	RICHARD JAMES	MANAGEMENT
SCHMIDT	NOEL GILBERT	MANAGEMENT
SCHOENFISCH	RUSSELL PHILLIP	MANAGEMENT
SHUMACK	HENRY	MANAGEMENT
SMITH	MARK ROBERT	MANAGEMENT
SPEARS	WILLIAM HARPER	MANAGEMENT
THIES	GARY	MANAGEMENT
TIDD	DONALD ARTHUR ERNEST	MANAGEMENT
TREW	ANTHONY NEVILLE	MANAGEMENT
TYE	GLEN EON	MANAGEMENT
TYLER	CHRISTOPHER ALAN	MANAGEMENT
WADDINGTON	HAL	MANAGEMENT
WOOD	WILLIAM BRETT	MANAGEMENT

SUPERVISORS

FAMILY NAME	GIVEN NAMES	CATEGORY
ABURN	ALAN DAVID ROBERT	SUPERVISOR
AGERBEEK	RUDOLF	SUPERVISOR
AHERN	MICHAEL JOSEPH	SUPERVISOR
AIZLEWOOD	GREGORY HAROLD	SUPERVISOR
ALECKSON	PHILIP JOHN	SUPERVISOR
ALLEN	CARL DAVID	SUPERVISOR
ALLEN	MICHAEL JOHN	SUPERVISOR
ALLEN	TREVOR GEORGE	SUPERVISOR
AMOS	RODNEY LLOYD	SUPERVISOR
ANDERSON	SHAWN PATRICK	SUPERVISOR
ASHTON	PETER STEWART	SUPERVISOR
ATLEY	STEPHEN JOSEPH PERCY	SUPERVISOR
BAKER	ALAN	SUPERVISOR
BAKER	TIM	SUPERVISOR
BALASSA	DAVID ANDREW	SUPERVISOR
BANNISTER	DEREK CHARLES	SUPERVISOR
BARNARD	KEITH	SUPERVISOR
BARNARD	EDWARD	SUPERVISOR/AWASCO

F-111 Deseal/Reseal Board of Inquiry

BARRETT	PAUL FRANCIS	SUPERVISOR
BATTERHAM	PAUL ALEXANDER	SUPERVISOR
BEALE	ROSS ALEXANDER	SUPERVISOR
BELLOTT	ANDREW MARTIN	SUPERVISOR
BENNETT	GREGORY RONALD WALTER	SUPERVISOR
BENNETT	RAYMOND	SUPERVISOR
BETTERIDGE	HUGH CHARLES	SUPERVISOR/HDH
BRIESE	PETER GEORGE	SUPERVISOR
BROWN	CARL RAYMOND	SUPERVISOR
BRUNNE	NOEL RUSSELL	SUPERVISOR
CANNAN	GREGORY EDWARD	SUPERVISOR
CAPPER	WILLIAM ANTHONY	SUPERVISOR
CECERE	CLAUDIO CHRISTOPHER	SUPERVISOR
CLARK	RONALD JOHN	SUPERVISOR
CLARK	STEVEN WILLIAM	SUPERVISOR
COATE	MURRAY DONALD	SUPERVISOR
COATES	ROGER JOHN	SUPERVISOR
DAVIS	BRUCE ROBERT	SUPERVISOR
DELATORRE	ANTHONY	SUPERVISOR
DEVENE	NEIL ROBERT	SUPERVISOR
DOGGETT	DENNIS RAYMOND	SUPERVISOR
DOHERTY	DESMOND ROBERT	SUPERVISOR
DOUGHTY	WARREN LINDSAY	SUPERVISOR
DOWDEN	CHRISTOPHER ROBIN	SUPERVISOR
DROVER	WAYNE RICHARD	SUPERVISOR
DWYER	MERVYN NOEL	SUPERVISOR
EGBERTS	ADUARD JOHANNES PIETER	SUPERVISOR
FELTON	PETER JAMES	SUPERVISOR
FINDLAY	HUGH RODERICK	SUPERVISOR
GALEA	MARTIN EDWARD	SUPERVISOR
GARDNER	DAVID WILLIAM	SUPERVISOR
GEDGE	EDWARD JAMES	SUPERVISOR
GODFREY	DESMOND NOEL	SUPERVISOR
GOEBEL	SHELDON GLENN	SUPERVISOR
GRANT	ANDREW	SUPERVISOR
HARDING	JAMES MALCOLM	SUPERVISOR
HARDY	MICHAEL JOHN	SUPERVISOR
HAUCK	GARY THOMAS	SUPERVISOR
HEDT	LIONEL EDWARD HEDT	SUPERVISOR
HEMPSALL	ANDREW JAMES	SUPERVISOR
HENNESSY	PETER DENIS	SUPERVISOR
JOC	STEVEN ANTHONY	SUPERVISOR
JOHNSON	ERROL HARDY	SUPERVISOR
JONES	GREGORY WAYNE	SUPERVISOR
JONES	STEPHEN KENNETH	SUPERVISOR
KENNETT	WILLIAM GEORGE	SUPERVISOR
KEOGH	ANTHONY JOHN	SUPERVISOR
KING	PAUL DAVID	SUPERVISOR
KLARENBECK	GARY JAMES	SUPERVISOR
LACK	DAVID JOHN	SUPERVISOR
MADSEN	ROBERT BRUCE	SUPERVISOR
MASSEY	MARK	SUPERVISOR
MCGRATH	BARRY THOMAS	SUPERVISOR
MCKINNON	DUNCAN JOHN	SUPERVISOR
MCPHERSON	STUART JOHN	SUPERVISOR

F-111 Deseal/Reseal Board of Inquiry

MEDVED	IVAN	SUPERVISOR
MICALLEF	GINO	SUPERVISOR
MILEVSKY	ROSS STEVEN	SUPERVISOR
MILLS	LEIGH ROBERT	SUPERVISOR
MIRALLEZ	MICHEL	SUPERVISOR
MOSS	PAUL JAMES	SUPERVISOR
MURPHY	GARRY	SUPERVISOR
MURPHY	CAREY JOHN	SUPERVISOR
O'CONNOR	RODNEY	SUPERVISOR
ORWIN	MARK WILLIAM	SUPERVISOR
PARKER	GARY DOUGLAS	SUPERVISOR
PARTRIDGE	COLIN EDWARD	SUPERVISOR
PILKINGTON	ROBERT JOHN	SUPERVISOR
POWER	THOMAS	SUPERVISOR
PROSSER	ROBERT STEPHEN	SUPERVISOR
RICHARDS	IAN	SUPERVISOR
RILEY	KEVIN PATRICK	SUPERVISOR
ROBERTSON	JAMES JOHN	SUPERVISOR
RYAN	PAUL JEREMY	SUPERVISOR
SADLER	BARRY JAMES	SUPERVISOR
SAGAIDAK	PAWEL	SUPERVISOR
SANDHAM	CHARLES	SUPERVISOR
SARGEANT	JOHN RICHARD	SUPERVISOR
SAYWELL	MAURICE	SUPERVISOR
SEYMOUR	RONALD WILLIAM	SUPERVISOR
SKELJO	THOMAS	SUPERVISOR
SMALL	GRANT	SUPERVISOR
SPARROW	SIMON VINCENT	SUPERVISOR
STEHBENS	BRIAN EDWIN	SUPERVISOR
STENZEL	DAVID KEITH	SUPERVISOR
STEPHENS	PATRICK MICHAEL	SUPERVISOR
STEPHENS	PATRICK MICHAEL	SUPERVISOR
STEVENS	FREDERICK ROY	SUPERVISOR
STILLER	DAVID MICHAEL	SUPERVISOR
TAYLOR	BRIAN	SUPERVISOR
TAYLOR	DUNCAN KEITH MORGAN	SUPERVISOR
TAYLOR	WALTER WILLIAM	SUPERVISOR
TUITE	DONALD MICHAEL	SUPERVISOR
TUNGATE	ROY WILFRED	SUPERVISOR
WALSH	ANTHONY JOHN	SUPERVISOR
WARD	REGINALD ROBERT	SUPERVISOR
WARREN	MALCOLM EDWARD	SUPERVISOR
WATSON	TERRY JAMES	SUPERVISOR
WEALE	JOHN JAMES	SUPERVISOR
WEBB	ROBERT FREDERICK	SUPERVISOR
WILD	GARY JAMES	SUPERVISOR
WILSON	PAUL JAMES	SUPERVISOR
WOODHOUSE	PHILIP JOHN	SUPERVISOR
WOODWARD	PETER JOHN	SUPERVISOR
WRIGHT	DOUGLAS WAYNE	SUPERVISOR
WRIGLEY	RAYMOND	SUPERVISOR
WYKES	LENARD THOMAS	SUPERVISOR
YARROW	MICHAEL HERBERT	SUPERVISOR

TRADESPERSONS

FAMILY NAME	GIVEN NAMES	CATEGORY
ABURN	ALAN DAVID ROBERT	(FATHER OF KEVIN GREGORY) TRADESPERSON
ACE	BRETT WAYNE	TRADESPERSON
ADAMS	SAMUEL RAYMOND	TRADESPERSON
ALEXANDER	GREGORY ROYCE C.	TRADESPERSON
ALLEN	LINDA JOY	TRADESPERSON
AMISS	ROGER PAUL	TRADESPERSON
AMUNDSEN	WARREN JOHN	TRADESPERSON
ANDERSON	JOHN	TRADESPERSON
ANDREWS	WILLIAM SCOTT	TRADESPERSON
ANSELL	CHRISTOPHER MARK	TRADESPERSON
ANSON	ANTHONY NEIL	TRADESPERSON
APPLEBY	BRYAN WAYNE	TRADESPERSON
ASHE	GREGORY JOHN	TRADESPERSON /HDH & AWASCO
BALDSIN	TERRY	TRADESPERSON
BALDWIN	TANYA LOUISE	TRADESPERSON
BALE	CHRISTOPHER JAMES	TRADESPERSON
BARNES	KEVIN JOHN	TRADESPERSON
BARNES	STEPHEN STANLEY	TRADESPERSON
BARRETT	DAVID MICHAEL	TRADESPERSON
BARRETT	RICKY JAMES	TRADESPERSON
BATE	CHRISTOPHER WILLIAM	TRADESPERSON
BAZZO	VIVIAN JOHN	TRADESPERSON
BEAL	ALICIA	TRADESPERSON
BEDDOES	RAYMOND MARK	TRADESPERSON
BEEKEN	RICHARD	TRADESPERSON
BELL	BARRIE	TRADESPERSON
BELL	HOWARD CLINTON	TRADESPERSON
BELLOTT	SUSANNE GAYE	TRADESPERSON
BENTLEY	STEPHEN JOHN	TRADESPERSON
BERENTSEN	ANTON PAUL	TRADESPERSON
BETTERHAM	PAUL ALEXANDER	TRADESPERSON
BISHOP	GARY NORMAN	TRADESPERSON
BISSETT	RAYMOND JOHN	TRADESPERSON
BLACKA	LAURENCE PATRICK	TRADESPERSON
BOGGAN	MICHAEL ROWAN	TRADESPERSON
BOHR	RICHARD JAMES	TRADESPERSON
BRADY	HANIDA MAU	TRADESPERSON
BRAND	JASON CHRISTOPHER	TRADESPERSON
BRANDSE	HENDRIK JOHANNES	TRADESPERSON
BRANDT	CHRISTOPHER JOHN MAURICE	TRADESPERSON
BREED	IAN CHARLES	TRADESPERSON
BRIDGE	GARRY ALFRED	TRADESPERSON
BRIGNELL	BENJAMIN O'CONNELL	TRADESPERSON
BROAD	RICHARD HENRY	TRADESPERSON
BROWN	ALLAN ARTHUR	TRADESPERSON
BROWN	GEORGE WAYNE	TRADESPERSON
BROWN	ROBERT REID	TRADESPERSON
BUFFETT	CRAIG WILLIAM	TRADESPERSON
BURGE	SCOTT ANTHONY	TRADESPERSON

BURRIDGE	JONATHAN CURTIS	TRADESPERSON
BUTCHER	CLAYTON JAMES	TRADESPERSON
BUTCHER	RUSSELL WAYNE	TRADESPERSON
BUTLER	NOEL IAN	TRADESPERSON
BYRNES	FRANK GEORGE	TRADESPERSON
CAMPBELL	MARK COLIN	TRADESPERSON
CARMODY	GLENN STEWART	TRADESPERSON
CARRIER	CRAIG IRWIN	TRADESPERSON
CARRUTHERS	ANDREW PAUL	TRADESPERSON
CARVOSSO	JOHN PHILLIP	TRADESPERSON
CHARLES	MARK ANDREW	TRADESPERSON
CHOICE	MARK ANDREW	TRADESPERSON
CLARK	CHRISTIAN ALEXANDER	TRADESPERSON
CLARK	NEIL	TRADESPERSON
COLLIER	NICHOLAS JOHN	TRADESPERSON
COLLINS	DONALD JOSEPH	TRADESPERSON
COLLINSON	JOHN NICHOLAS	TRADESPERSON
CONNELL	ROBERT	TRADESPERSON
COOK	DEAN ASHLEY	TRADESPERSON
COONAN	STEWART JOHN	TRADESPERSON
COOPER	FRANCIS BERNARD	TRADESPERSON
COPELAND	ALAN RONALD	TRADESPERSON
COTTER	SEAN PATRICK	TRADESPERSON
COUCHMAN	ROBERT PAUL	TRADESPERSON
COX	FREDERICK STANLEY	TRADESPERSON
COX-NORMAN	BARRY	TRADESPERSON
CRAVEN	GREGORY STUART	TRADESPERSON
CRIMEAN	JOHN MICHAEL	TRADESPERSON
CROSS	KENNETH JOHN	TRADESPERSON
CROTHERS	ROBIN MICHAEL	TRADESPERSON
CROWLEY	CORNELIUS MICHAEL	TRADESPERSON
CULLEY	IAN	TRADESPERSON
CUNNINGHAM	GEORGE BALL	TRADESPERSON
CURL	GEOFFREY MICHAEL	TRADESPERSON
D'ANDILLY	MICHAEL	TRADESPERSON
DANIEL	ROSS JAMES	TRADESPERSON
DAUGHTREE	MALCOLM IAN	TRADESPERSON
DAVIDSON	ALLAN LEX	TRADESPERSON
DAVISON	GARY	TRADESPERSON
DE JONG	PETER MARTIN	TRADESPERSON
DE VINE	BRANDON	TRADESPERSON
DENMAN	RICHARD SCOTT	TRADESPERSON
DENSLEY	JEFFREY COLIN	TRADESPERSON
DERBY	CATHERINE JANE	TRADESPERSON
DICKER	GLEN PATRICK	TRADESPERSON
DILLON-SHALLARD	DAVID BRUCE	TRADESPERSON
DIX	TREVOR WARREN	TRADESPERSON
DIXON	ADRIAN STUART	TRADESPERSON
DOCKSEY	BRETT JAMES	TRADESPERSON
DOCTOR	ALAN	TRADESPERSON
DOPSON	JEFFREY ALAN	TRADESPERSON
DUCKWORTH	MICHAEL LAURENCE	TRADESPERSON
DUDLEY	GORDON ARTHUR	TRADESPERSON
DULL	ARNOLD BERNARD	TRADESPERSON
DUNKLEY	IAN HAMILTON	TRADESPERSON

DUTTON	WAYNE JOHN	TRADESPERSON
EATON	MARK WILLIAM	TRADESPERSON
EDEN	RICHARD	TRADESPERSON
EGGMOLESSE	VERNON JOHN	TRADESPERSON
EHLERS	WAYNE EDWARD	TRADESPERSON
ELLIS	GARY STEPHEN	TRADESPERSON
ELVIN	GRAHAM THOMAS	TRADESPERSON
EMERY	PETER JAMES	TRADESPERSON
ESPOSITO	KEVIN JAMES	TRADESPERSON
EVANS	CHRISTOPHER	TRADESPERSON
EVANS	GRAHAM	TRADESPERSON
EYRE	PAUL WALLACE	TRADESPERSON
FATT	LAURENCE ANTHONY	TRADESPERSON
FELLS	JOHN LESLIE	TRADESPERSON
FENECH	MARK STEVEN	TRADESPERSON
FERGUSON	JARROD LEIGH	TRADESPERSON
FINDLAY	NEIL JOHN	TRADESPERSON
FINDLAYSON	PAUL TREVOR	TRADESPERSON
FISHER	SCOTT EVERETT	TRADESPERSON
FLEMING	PETER JAMES MAUGHAN	TRADESPERSON
FLYNN	SHAYNE THOMAS	TRADESPERSON
FOGO	DARRYL KENNETH	TRADESPERSON
FORBES	RAYMOND	TRADESPERSON
FORD	ANDREW KEITH	TRADESPERSON
FRANCIS	IAN ERNEST	TRADESPERSON
FRANCIS	KEVIN JOHN	TRADESPERSON
FRANKE	MARK DOUGLAS	TRADESPERSON
FRANZI	ROSS ERNEST	TRADESPERSON
FRASER	IAN RAYMOND	TRADESPERSON
FREEMAN	MARK DANIEL	TRADESPERSON
FRENCH	MICHAEL DOUGLAS	TRADESPERSON
FROHLOFF	BRADLEY JOHN	TRADESPERSON
FROST	JASON MICHAEL	TRADESPERSON
GALLAGHER	GRAHAM PHILLIP	TRADESPERSON
GANNON	BRADLEY FRANCIS	TRADESPERSON
GATELY	ROBERT GEORGE PHILLIP	TRADESPERSON
GAWLEY	IAN JOHN	TRADESPERSON
GIBSON	BRETT ANTHONY	TRADESPERSON
GILMORE	SAMUEL ROSS ALEXANDER	TRADESPERSON
GLADWIN	STEPHEN ROBERT	TRADESPERSON
GODFREY	DAVID NOEL	TRADESPERSON
GODFREY	KAY ANN	TRADESPERSON
GOODCHILD	JACQUELINE KIM	TRADESPERSON
GRADY	KEITH JAMES	TRADESPERSON
GRANT	STEVEN DOUGLAS	TRADESPERSON
GREENSLADE	ANTHONY GEORGE	TRADESPERSON
GRIFFITHS	JASON	TRADESPERSON
GRIMMETT	RUPERT	TRADESPERSON
GROOBY	BARRY ANTHONY	TRADESPERSON
GROSSER	KYMTON DENIS	TRADESPERSON
GROUNDWATER	IAN ERIC	TRADESPERSON
GUNNIS	FRANCIS WILLIAM	TRADESPERSON
GURMAN	DAVID JOHN	TRADESPERSON
GUTHRIE	WILLIAM JOHN	TRADESPERSON
HADDON	SIMON ROBIN PETER	TRADESPERSON

HAGLEY	ANDREW MARK	TRADESPERSON
HALL	GRAHAME LESLEY	TRADESPERSON
HALL	GRANT JOHN	TRADESPERSON
HALL	JOHN CHARLES	TRADESPERSON
HALL	PETER JOHN	TRADESPERSON
HALLORAN	CLAYTON JONATHON	TRADESPERSON
HARBOUR	MARK	TRADESPERSON
HARMER	GEOFFREY DONALD	TRADESPERSON
HARRISON	DAVID	TRADESPERSON
HARRISON	TERRENCE VERDON	TRADESPERSON
HASTIE	ARCHIBALD	TRADESPERSON
HASTINGS	RUSSELL	TRADESPERSON
HAYES	DAVID ALLEN	TRADESPERSON
HEALY	PATRICK MICHAEL	TRADESPERSON
HEATHCOTE	DAVID MARK	TRADESPERSON
HENSLER	BARRY JOHN	TRADESPERSON
HERON	PHILLIP JOHN	TRADESPERSON
HEY	KENNETH RAYMOND	TRADESPERSON
HINSPETER	KEVIN FRANCIS	TRADESPERSON
HOBBINS	CHRISTOPHER NEIL	TRADESPERSON
HOGBIN	GARY JAMES	TRADESPERSON
HOGER	JAMES ANDREW	TRADESPERSON
HOLMES	SCOTT ANTHONY	TRADESPERSON
HOPKINS	STEPHEN ANDREW	TRADESPERSON
HORSBURGH	JOHN	TRADESPERSON
HOUGHTON	ROBERT JAMES	TRADESPERSON
HOUSTON	TERENCE MARSHALL CHARLES	TRADESPERSON
HUBBARD	RICHARD JOHN	TRADESPERSON
HUGHES	WAYNE MILTON	TRADESPERSON
HUNOLD	STEPHEN JOHN	TRADESPERSON
HUTTEN	LEO JOSEPH	TRADESPERSON
HYLAND	NIGEL JOHN	TRADESPERSON
IVERSEN	DALLAS	TRADESPERSON
JACKETT	STEVEN	TRADESPERSON
JACKSON	ERIC	TRADESPERSON
JACOBSON	RICHARD	TRADESPERSON
JAMES	ARTHUR ROSS	TRADESPERSON
JEFFREY	ROBERT PAUL	TRADESPERSON
JESINOWSKI	DION ALEXANDER	TRADESPERSON
JOINER	HEATH ASHLEY	TRADESPERSON
JONES	DAVID JAMES	TRADESPERSON
JONES	JASON MICHAEL	TRADESPERSON
JONES	PETER WAYNE	TRADESPERSON
JORDAN	MARK	TRADESPERSON
JOYCE	JOHN FREDERICK	TRADESPERSON
JURGA	STEPHAN ROY	TRADESPERSON
KEHAGIAS	MICHAEL DAVID	TRADESPERSON
KELSEY	ALASTAIR SIMON	TRADESPERSON
KENNEDY	JOHN ANDREW	TRADESPERSON
KENNEDY	STEVEN CHARLES	TRADESPERSON
KENNEDY	WILLIAM ALEXANDER	TRADESPERSON
KENT	GARY	TRADESPERSON
KERR	GRAHAME DAVID	TRADESPERSON
KETCHELL	BRENDON NORMAN	TRADESPERSON
KIDD	WARREN NORMAN	TRADESPERSON

KIRK	ROBERT WILLIAM	TRADESPERSON
KLINCKE	ROBERT CHARLES	TRADESPERSON
KNIGHT	RODNEY TREVOR	TRADESPERSON
KORN	GREGORY JOHN	TRADESPERSON
KRAUSE	CRAIG ANDREW	TRADESPERSON
KUSSROW	MARK LESLEY	TRADESPERSON
LACK	DAVID JOHN	TRADESPERSON
LAKNER	JOHN JOSEPH	TRADESPERSON
LAMBERT	DENNIS CECIL	TRADESPERSON
LANDEMAN	ALLEN BRUCE CRAVEN	TRADESPERSON
LANE	RICHARD ADAM	TRADESPERSON
LEA	RAYMOND BRIAN	TRADESPERSON
LECINSKI	PETER	TRADESPERSON
LEGGATT	PETER MICHAEL	TRADESPERSON
LEHANE	DAVID WILLIAM	TRADESPERSON
LEONARD	KEVIN FRANCIS	TRADESPERSON
LIETZOW	KENNETH ROSS	TRADESPERSON
LINDBURG	DAVID BRANT	TRADESPERSON
LINDGREN	PETER JOHN	TRADESPERSON
LIPPINKHOF	STEPHEN DAVID	TRADESPERSON
LIVINGSTONE	IAN	TRADESPERSON
LUDGATER	MARK ANDREW	TRADESPERSON
LUNN	NOEL PAUL	TRADESPERSON
LYON	WAYNE ROBERT	TRADESPERSON
MACKIE	PHILLIP SCOTT	TRADESPERSON
MAGNUSSON	JOHN LENNART	TRADESPERSON
MAHER	WAYNE CHARLES	TRADESPERSON
MAKELA	IAN ARTHUR	TRADESPERSON
MALLET	BARRY RALPH	TRADESPERSON
MANNING	PETER JOHN	TRADESPERSON
MANUEL	JOHN JAMES	TRADESPERSON
MARTIN	GREGORY PHILLIP	TRADESPERSON
MARTIN	PETER JAMES	TRADESPERSON
MAXWELL	DAVID RONALD	TRADESPERSON
MAXWELL	GAVIN THOMAS	TRADESPERSON
McANALLY	ALLAN EDWARD	TRADESPERSON
McCLYMONT	WILLIAM HUGH	TRADESPERSON
McCULLOCH	PAUL ANDREW	TRADESPERSON
McDONALD	BRETT	TRADESPERSON
MCDOUGAL	ANDREW BRUCE	TRADESPERSON
McGARRIGLE	KEVIN WILLIAM	TRADESPERSON
McLEAN	NEVILLE RONALD JAMES	TRADESPERSON
McNEICE	BRYAN ROSS	TRADESPERSON
MEADOWS	ALAN WALTER	TRADESPERSON
MEDWELL	MARK EVERETT	TRADESPERSON
METCALF	ALEX WILLIAM	TRADESPERSON
MIDDAP	LEIGH MAXWELL	TRADESPERSON
MILES	CRAIG STEPHEN	TRADESPERSON
MILLIS	ROBIN JAMES	TRADESPERSON
MOHAPP	SEAN ALBERT	TRADESPERSON
MOLLOY	JEFFREY PETER	TRADESPERSON
MOLLOY	NORMAN CHARLES	TRADESPERSON
MORAN	LEON ROBERT	TRADESPERSON
MORRELL	ANDREW DAVID	TRADESPERSON
MORRIS	ANDREW KENNETH	TRADESPERSON

MORROW	GLEN ANTHONY	TRADESPERSON
MOTT	ANTHONY WILLIAM	TRADESPERSON
MURPHY	SHANE TERENCE	TRADESPERSON
MURRAY	GERARD ANTHONY	TRADESPERSON
MUTZELBURG	BRADLEY GRAEME	TRADESPERSON
MYLREA	CRAIG CHARLTON	TRADESPERSON
NAPIER	ROBERT MAXWELL	TRADESPERSON
NAPPER	STEPHEN ERIC	TRADESPERSON
NASH	CHRISTOPHER JOHN	TRADESPERSON
NEAL	WARREN DESMOND	TRADESPERSON
NEAL	LLOYD ROBERT	TRADESPERSON
NEIL	WALTER	TRADESPERSON
NEILSON	CHRISTY ROBERT	TRADESPERSON
NEVIN	PAUL WILLIAM	TRADESPERSON
NEWELL	STEVEN JOHN	TRADESPERSON
NIELSEN	CHRISTY ROBERT	TRADESPERSON
NIELSEN	NATALIE	TRADESPERSON
NORTHEY	BRETT ANTHONY	TRADESPERSON
NORTHOVER	CRAIG STEVEN	TRADESPERSON
NOWLAN	LUKE MICHAEL	TRADESPERSON
OHMSEN	GEOFFREY JAMES	TRADESPERSON
OLDFIELD	KAREN	TRADESPERSON (WIFE OF)
OLSEN	ROSS COLIN	TRADESPERSON
OLSEN	SCOTT JOHN	TRADESPERSON
OWERS	JEFFREY	TRADESPERSON
PAGE	JUSTIN DAVID	TRADESPERSON
PAGETT	NIGEL DOMINIC	TRADESPERSON
PAINE	LORELLE	TRADESPERSON
PAINE	RICHARD THOMAS	TRADESPERSON
PANITZ	TERENCE MICHAEL	TRADESPERSON
PANNELL	CLIFF	TRADESPERSON
PARKER	CHETWYN JOHN ANTHONY	TRADESPERSON
PARKER	ROBERT JOHN	TRADESPERSON
PARKER	TREVOR WAYNE	TRADESPERSON
PARKES	IAN CHARLES	TRADESPERSON
PASHEN	DAVID JOHN	TRADESPERSON
PASLEY	MARK ANDREW	TRADESPERSON
PATTERSON	ALAN	TRADESPERSON
PATTERSON	MAXWELL EDGAR	TRADESPERSON
PAWLENKO	SHAYNE MICHAEL JOSEPH	TRADESPERSON
PAYTON	MAXWELL RICHARD	TRADESPERSON
PEACOCK	NIGEL KEITH	TRADESPERSON
PEARMAN	ROBERT JOHN	TRADESPERSON
PEATE	DAVID HENRY WILLIAM	TRADESPERSON
PERREN	RUSSELL KEITH	TRADESPERSON
PERRY	JAMES ANTHONY	TRADESPERSON
PETERSON	MICHAEL JOHN	TRADESPERSON
PETTY	DANIEL EDWARD	TRADESPERSON
PFEFFER	BRETT CAMERON	TRADESPERSON
PHILLIPS	MARSHALL GEOFFREY	TRADESPERSON
PICKERING	SARAH LOUISE	TRADESPERSON
PIKE	JEFFREY WILLIAM	TRADESPERSON
PIPER	MICHAEL JOHN	TRADESPERSON
PITMAN	DONALD JOHN	TRADESPERSON

PLEWS	BRADLEY PHILLIP	TRADESPERSON
PODBURY	SHAUN ANDREW	TRADESPERSON
PORTER	RUSSELL JOHN	TRADESPERSON
POTTER	DAVID ALLAN	TRADESPERSON
POULSEN	PAUL RONALD	TRADESPERSON
PRIESTLY	GARY BRUCE	TRADESPERSON
QUALISCHEFSKI	VANESSA MARIE	TRADESPERSON
QUATERMASS	PETER MCDONALD	TRADESPERSON
QUIRK	PATRICK MICHAEL	TRADESPERSON
RALPH	SEAN KEITH	TRADESPERSON
RAMSAY	COLIN JAMES	TRADESPERSON
RAMSDEN	ANTONY JOHN	TRADESPERSON
RASMUSSEN	BRUCE	TRADESPERSON
REEVES	DREW WARREN	TRADESPERSON
RICKETTS	JOHN DOUGLAS	TRADESPERSON
RIGDEN	DOUGLAS WILLIAM BROWNING	TRADESPERSON
RIGGS	RONALD WAYNE	TRADESPERSON
ROBERTS	NEILL TREVOR	TRADESPERSON
ROBERTSON	PETER ROBERT	TRADESPERSON
ROCHFORD	SHANE ARTHUR	TRADESPERSON
RODWAY	MARK TIMOTHY	TRADESPERSON
ROGERS	ALLAN WALTER	TRADESPERSON
ROMEYN	FREDERIK	TRADESPERSON
ROONEY	LIAM GILBERT	TRADESPERSON
ROONEY	MARK ANDREW	TRADESPERSON
ROSE	OWEN VICTOR	TRADESPERSON
ROSS	DAVID THOMAS	TRADESPERSON
ROSSITER	MATTHEW ALAN	TRADESPERSON
RUMSEY	PAUL EDWARD JOHN	TRADESPERSON
RUNGE	DESMOND WILLIAM	TRADESPERSON
RUPRECHT	MARTIN	TRADESPERSON
RUTH	PETER JOHN	TRADESPERSON
RYAN	JEFFREY JAMES	TRADESPERSON
RYAN	JOHN	TRADESPERSON
RYBARCZYK	BERT ERICH	TRADESPERSON
SALLAWAY	TERRY CLIFFORD	TRADESPERSON
SAUNDERS	DEAN ANDREW	TRADESPERSON
SAVILLE	TIMOTHY JOHN	TRADESPERSON
SCHLEEMAN	JURGEN (YOGI)	TRADESPERSON
SCHLOSS	TREVOR JOHN	TRADESPERSON
SCOTT	GEORGE DUNN	TRADESPERSON
SEIBEL	PHILIP JOHN	TRADESPERSON
SEYMOUR	LORICE	TRADESPERSON
SEYMOUR	RONALD WILLIAM	TRADESPERSON
SHAMBLER	MARK	TRADESPERSON
SILLENCE	DERRICK THOMAS	TRADESPERSON
SIMMICH	RAYMOND ARTHUR	TRADESPERSON
SIMPSON	RAYMOND JAMES	TRADESPERSON
SINCLAIR	MARK ANTHONY	TRADESPERSON
SINCLAIR	SCOTT ANDREW	TRADESPERSON
SJOSTEDT	JOHN FREDERICK	TRADESPERSON
SKINNER	PETER JOHN	TRADESPERSON
SMITH	KEITH WILLIAM	TRADESPERSON
SMITH	NICHOLAS DAN	TRADESPERSON
SMITH	RODERICK EARNEST CRAIG	TRADESPERSON

F-111 Deseal/Reseal Board of Inquiry

SOLOMONS	ROBIN GRANT	TRADESPERSON
SPALDING	MICHAEL ROYCE	TRADESPERSON
SPENCER	BARRY REGINALD	TRADESPERSON
SPIES	KEVIN ANDREW	TRADESPERSON
STALLARD	NEIL WILLIAM	TRADESPERSON
STARK	CLINTON TROY	TRADESPERSON
STEART	SCOTT ANTHONY CLIFFORD	TRADESPERSON
STEINHARDT	GARTH HOWARD	TRADESPERSON
STEWART	CARL ANTHONY	TRADESPERSON
STOWER	GAVIN JEFFREY	TRADESPERSON
STRICKLAND	DAVID JAMES	TRADESPERSON
STUART	PAUL CAMPBELL	TRADESPERSON
STYLES	RONALD LESLIE	TRADESPERSON
SUNNERDALE	LEON MICHAEL	TRADESPERSON
SUTHERLAND	JOHN RODERICK	TRADESPERSON
SWEENEY	LUKE VINCENT	TRADESPERSON
TARDA	PETER SALVATORE	TRADESPERSON
TARRANT	ROBERT JAMES	TRADESPERSON
TAYLOR	DARRIN JOHN	TRADESPERSON
TAYLOR	MARK WILLIAM	TRADESPERSON
TAYLOR	RONALD DEAN	TRADESPERSON
TAYLOR	THOMAS GEOFFREY	TRADESPERSON
THIELE	WILLIAM JOHN MAXWELL	TRADESPERSON
THOMAS	ROSS JAMES	TRADESPERSON
THOMSON	DAVID JON MCGREGOR	TRADESPERSON
THORPE	PETER JAMES	TRADESPERSON
TIBBEY	GLEN DAVID	TRADESPERSON
TINSLEY	THOMAS WILLIAM	TRADESPERSON
TONKIN	THOMAS ARTHUR	TRADESPERSON
TOWNSEND	RAYMOND HERBERT	TRADESPERSON
TRELEAVEN	DANIEL BYRON	TRADESPERSON
TREWICK	ANTHONY LYLE	TRADESPERSON
TREWIN	ADAM RUSSELL	TRADESPERSON
TRIEBE	CHRISTOPHER FREDERICK	TRADESPERSON
TUCKER	ROBERT JAMES	TRADESPERSON
TURNA	JAROSLAV GARRY	TRADESPERSON
TWINE	TERRY	TRADESPERSON
VESANDER	MARKKU OLAVI	TRADESPERSON
VICKERY	ALLAN ERNEST	TRADESPERSON
VINCENT	ALAN STUART	TRADESPERSON
VINER	RAYMOND GEORGE	TRADESPERSON
WAIT	GREGORY PAUL	TRADESPERSON
WALKER	DAVID ALEXANDER	TRADESPERSON
WALKER	WILLIAM ANTHONY	TRADESPERSON
WALLIS	JAMES	TRADESPERSON
WATSON	GREGORY MARK	TRADESPERSON
WEATHERBY	KEITH MARK	TRADESPERSON
WEBSTER	RAYMOND JOHN	TRADESPERSON
WEIER	PETER WILHELM	TRADESPERSON
WELLS	MICHAEL ANDREW	TRADESPERSON
WENT	STEWART JAMES	TRADESPERSON
WHEELER	PHILLIP WILLIAM	TRADESPERSON
WHEELER	STEVEN WAYNE	TRADESPERSON
WHITE	BRETT JOHN	TRADESPERSON
WHITE	STEVEN BRADLEY	TRADESPERSON

WHITTON	BARRY JAMES	TRADESPERSON
WILLCOX	STEVEN PAUL	TRADESPERSON
WILLI	NOEL RODNEY	TRADESPERSON
WILLIAMSON	MARK	TRADESPERSON
WILSON	CLAYTON DREWE	TRADESPERSON
WOODS	LEX LESLIE	TRADESPERSON
WOODSELL	JASON STUART	TRADESPERSON
WOOLACOTT	KIM RUSSELL	TRADESPERSON
WRIGHT	ASHLEY TODD	TRADESPERSON
WUOTI	PETER JAMES	TRADESPERSON
WUOTI	TREVOR JOHN	TRADESPERSON
YOUNG	BRUCE EDWARD	TRADESPERSON
YOUNG	IAN LESLIE	TRADESPERSON
ZUGNO	OSCAR ROBERTO	TRADESPERSON

LIST OF WITNESSES WHO APPEARED BEFORE THE BOARD

DATE OF APPEARANCE	NAME/RANK	PRESENT APPOINTMENT	CATEGORY (RELEVANCE)
28-Feb-2001	GPCAPT R SARGEANT	OC501WG	OC 501WG
21-Mar-2001	GPCAPT P SHUMACK	MEDICAL PRACTITIONER	RAAF AMBERLEY
21-Mar-2001	DR E DONALDSON	MEDICAL PRACTITIONER	EXPERT WITNESS
21-Mar-2001	DR D LEWIS	MEDICAL PRACTITIONER	EXPERT WITNESS
21-Mar-2001	CAPT L J MEREDITH	ROYAL AUSTRALIAN ARMY NURSING CORP	F111 D/R BOI MED PROGRAM
22-Mar-2001	DR K W A HORSLEY	MEDICAL SERVICES ADVISOR, DEPARTMENT OF VETERAN AFFAIRS	F111 D/R DVA HEALTH STUDY MANAGER
22-Mar-2001	WGCDR A MORRISON	CO 501 AMSQN	CO 501 AMSQN
26-Mar-2001	MR R WEBSTER		TRADESPERSON
26-Mar-2001	MR P DE JONG		TRADESPERSON
26-Mar-2001	MR I FRASER		TRADESPERSON
26-Mar-2001	MR A MOTT		TRADESPERSON
26-Mar-2001	MR G CURL		TRADESPERSON
27-Mar-2001	MR D DOHERTY		WOFF ENGINEER
27-Mar-2001	MR P FELTON		WOFF ENGINEER
27-Mar-2001	MR J HALL		TRADESPERSON
27-Mar-2001	CPL H JOINER	AAMS 501WG	TRADESPERSON
27-Mar-2001	WOFF G MURPHY	23 SQN	SUPERVISOR
28-Mar-2001	MR S DANEK	SENIOR PROFESSIONAL OFFICER, DSTO AMRL	EXPERT WITNESS
28-Mar-2001	AIRCDRE C TYLER	CONSULTANT, DEFENCE INDUSTRY	OIC NDISL; OIC AMS; CO 3AD; OC 501WG; OTC 501WG
28-Mar-2001	SGT R KNIGHT	NO 1 SQN	TRADESPERSON
28-Mar-2001	CPL S GRANT	AAMS 501WG	TRADESPERSON
29-Mar-2001	MR J MACCARONE	SENIOR INSPECTOR BP OIL REFINERY BRISBANE	OIC AMS 3AD
29-Mar-2001	MR M ORWIN		SGT FTRS AMSQN
29-Mar-2001	CPL W H MCCLYMONT	AAMS 501WG	SUPERVISOR, TRADESPERSON
2-Apr-2001	M H WADDINGTON	EMOHSO 501WG	EMOHSO 501WG
2-Apr-2001	DR B PAUL	DSTO	DSTO
2-Apr-2001	SGT R CONNOR	QUALITY/HEALTH & SAFETY COORDINATOR	QUALITY ASSURANCE COORDINATOR & OH&S ADVISOR
3-Apr-2001	AIRCDRE N SCHMIDT	DIRECTOR GENERAL OF TECHNICAL AIRWORTHINESS	OIC 501WG/DGTA
3-Apr-2001	DR D M NEWMAN	CONSULTING ENGINEER	OIC ASF 3AD
3-Apr-2001	FSGT C MURPHY	EH&S RAAF AMB	EH&S
4-Apr-2001	DR M R DUGDALE	MEDICAL PRACTITIONER, RAAF AMBERLEY	SMO AMB, DAF MED

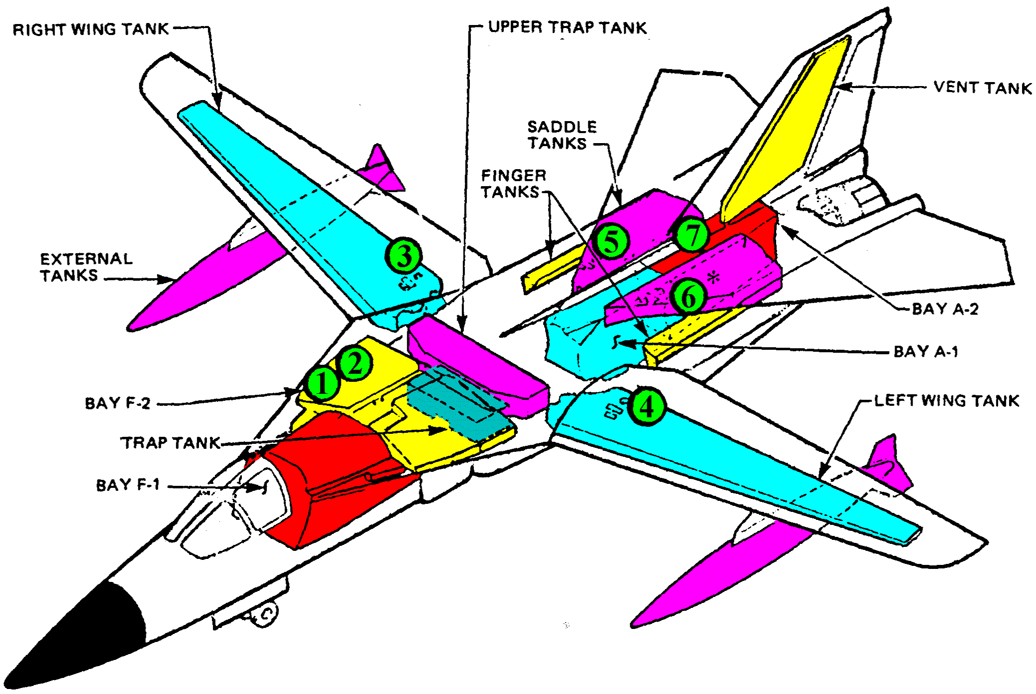
DATE OF APPEARANCE	NAME/RANK	PRESENT APPOINTMENT	CATEGORY (RELEVANCE)
4-Apr-2001	WGCDR M J O'DONOGHUE	OIC HSF RAAF BASE WILLIAMTOWN	SMO RAAF BASE AMBERLEY
4-Apr-2001	DR D W HARREX	SPECIALIST IN OCCUPATIONAL MEDICINE/CONSULTA NT TO DVA	SMO RAAF BASE AMBERLEY, DGAFHS
5-Apr-2001	CPL WH McCLYMONT	501WG	SUPERVISOR TRADESPERSON
5-Apr-2001	A N TREW	MANAGER	CHIEF ENGINEER, COAMSQN 501 WG
5-Apr-2001	SGT L MILLS	SNCO CSF AMBERLEY	SNCO FTRS
5-Apr-2001	M W ORWIN		SGT FTRS AMSQN
5-Apr-2001	FLTLT S DORNEY	OIC ASF	OIC AMS
9-Apr-2001	MR B SARGEANT	DIRECTOR GENERAL SAFETY COMPENSATION & PEOPLE DEVELOPMENT	DIRECTOR GENERAL SAFETY COMPENSATION & PEOPLE DEVELOPMENT
9-Apr-2001	MR G TYE	DIRECTOR, DSMA	DIRECTOR, DSMA
9-Apr-2001	CAPT A ROBERTSON RAN	DIRECTOR, JOINT HEALTH SUPPORT AGENCY	DIRECTOR, JOINT HEALTH SUPPORT AGENCY
9-Apr-2001	GPCAPT W SPEARS	DIRECTOR FLYING SAFETY - ADF	DIRECTOR FLYING SAFETY - ADF
10-Apr-2001	MAJ P K S FOWLER	SO2 SYSTEMS DEFENCE SAFETY MANAGENEMENT AGENCY	SO2 SYSTEMS DEFENCE SAFETY MANAGENEMENT AGENCY
10-Apr-2001	BRIG K MELOR	DEFENCE FORCE WELFARE ASSOCIATION	DEFENCE FORCE WELFARE ASSOCIATION
10-Apr-2001	WGCDR J ROWE	DIRECTOR AIR FORCE GROUND SAFETY AGENCY	DIRECTOR AIR FORCE GROUND SAFETY AGENCY
10-Apr-2001	MS K TURNER	DIRECTOR, AEROSAFE RISK MANAGEMENT PTY LTD	EXPERT WITNESS
10-Apr-2001	WGCDR S W SECKER	PROJECT OFFICER SRSPO 501WG	501 WG INVESTIGATING OFFICER
9-May-2001	LTCOL D MOYLAN	DIRECTOR, SAFETY MANAGEMENT LAND	EXPERT WITNESS
9-May-2001	CAPT A McKINNIE RAN	DIRECTOR GENERAL OF NAVAL CERTIFICATION, SAFETY & ACCEPTANCE AGENCY	EXPERT WITNESS

CHAPTER 2 – BACKGROUND - THE DESEAL/RESEAL PROGRAMS IN PERSPECTIVE

BACKGROUND AND OVERVIEW TO THE F-111 DESEAL/RESEAL PROGRAMS

2.1. The Australian Government ordered 24 General Dynamics (GD) F-111 aircraft (then designated TFX) in October 1963. The aircraft was still 'on the drawing board' when ordered and was not scheduled for delivery until September 1968. Whilst the maiden flight of the F-111C Australian model was achieved in July 1968 and the first aircraft was accepted in October 1968, problems with the Wing Carry Through Box (WCTB) resulted in the Australian aircraft being put immediately into storage. (In March 1968, eight USAF 'Combat Lancer' F-111A aircraft deployed to Thailand to contribute to the 'Rolling Thunder' bombing campaign over North Vietnam. When the third aircraft loss due to mechanical failure occurred on 22 April 1968, operations were suspended and the remaining aircraft returned to the US.) RAAF crews subsequently went to Fort Worth Texas, in December 1969, to take delivery of the aircraft but the loss of another USAF F-111A aircraft caused the Australian aircraft to be returned to storage. By May 1973, the F-111Cs had new WCTBs and were finally cleared for delivery. The first six aircraft arrived at Amberley on 1 June 1973; the twenty-fourth was delivered on 31st October the same year.

2.2. The internal fuel tanks on the F-111 are integral to the aircraft's structure. This maximises the fuel that can be carried to give the extended range required of the aircraft. Each available cavity within the fuselage and wings is sealed using a curable sealant applied between mating structural components, for example skin and bulkheads and around fasteners.



2.3. Within three months of arrival in Australia, the RAAF found what appeared to be uncured fuel tank sealant when investigating aviation turbine (AVTUR) fuel leak problems. Shortly thereafter, the RAAF became aware of serious fuel leak problems being experienced by the USAF on their F-111 aircraft. Because of the extended time the Australian aircraft had spent in storage, the apparent degrading of the polyester faying surface sealant used at manufacture and the USAF experience, the RAAF became resigned to significant fuel leak problems on the F-111Cs. (As an observation, the polyester sealant does not have a Military Specification which therefore raises questions as to how well the GD material specification, addressing performance, handling and application, and hydrolytic stability, was tested prior to certifying for use in aircraft assembly. It seems the sealant was selected because of its high temperature properties alone.)

2.4. The method of sealing the fuselage integral fuel tanks was to apply the polyester adhesive sealant between faying surfaces and in structural voids, complemented by beads of polysulphide fillet sealant (MIL-S-83430) along seams and around the fasteners within the tanks. Unfortunately, the polyester sealant degraded over time and 'reverted' (the common term used to describe the sealant condition). In essence, the sealant was hydrolytically unstable and the effect was the rupture of the fillet seal by hydraulic action and/or chemical reaction at multiple sites; hence the fuel leaks.

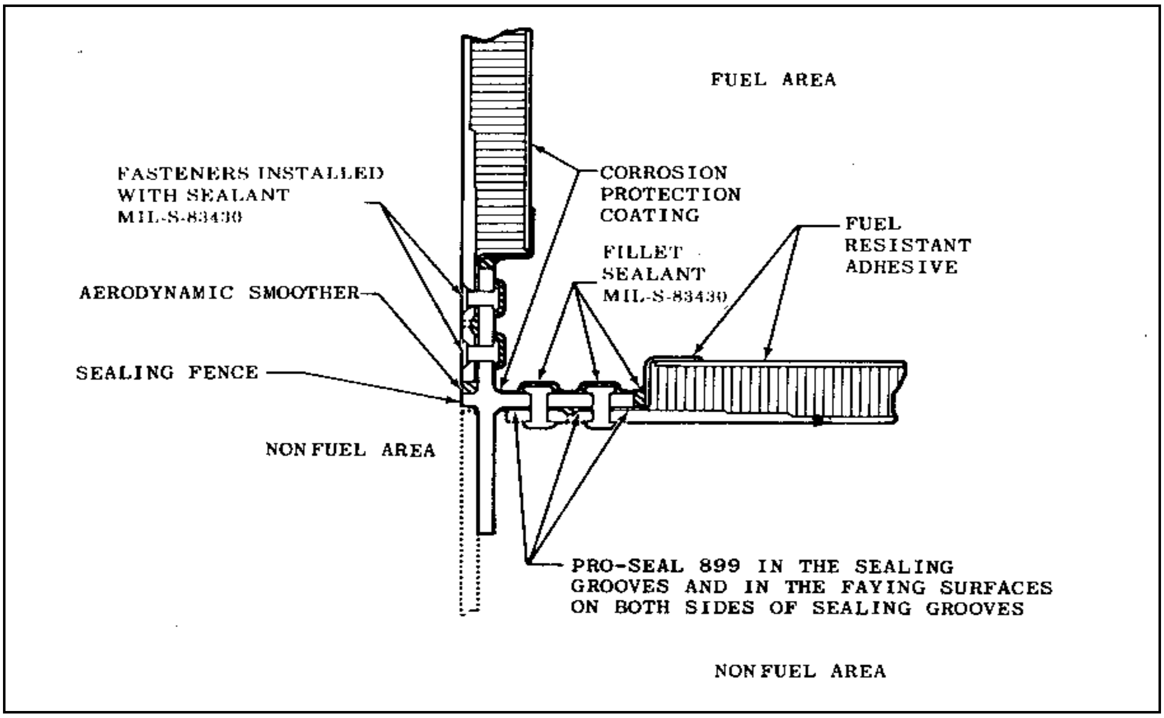


Figure 2: Multiple Barrier Sealing System

2.5. The F-111 was something of a political 'hot potato' at the time and every effort was no doubt committed to maximising aircraft availability and in-service performance. The USAF had commenced a 'deseal/reseal' program at Sacramento Air Logistics Centre (SM-ALC) and, not surprisingly, the RAAF also decided on the need for a fuselage deseal/reseal program (DSRS), with procedures based on those developed by GD Fort Worth Division (GD/FW) and used by the USAF. This first program (at the time it was hoped to have been the only one needed) was conducted by No 3 Aircraft Depot (3AD) at RAAF Amberley on eleven aircraft between October 1977 and February 1982. The rest of the fleet (nine aircraft - four had been lost in service) was submitted to the program in the USAF facilities at Sacramento, between May 1981 and December 1982, coincident with the first Cold Proof Load Test (CPLT) program.

2.6. Perhaps the most notorious aspect of the initial program was the extensive use of a chemical desealant known as SR51. This desealant had a strong, foul odour which directed attention at Amberley to the quarantined work area at the southern end of the Base. Indeed, there were a number of complaints from Ipswich residents about the foul odour emanating from the Base. Employment in the 'rag hangar', a canvas deployable hangar (one of seven RAAF assets and relocated from No 482 Squadron (482SQN)) where the chemical desealing took place, was to be avoided if at all possible. This environment was not dissimilar to that at Sacramento and the advantage of using the desealant was that it was far quicker than desealing by mechanical means only. The process required Air Force tradespeople, many straight from basic trade training, to spend extended periods of their working day in the very cramped and confined spaces of the various fuselage fuel tanks. Because the resealing process relied critically on the removal of as much of the old sealant as possible (complete removal of the faying surface sealant was not possible without completely disassembling the aircraft and careful surface preparation), the desealing work was painstaking. Each aircraft was required in work for about six months.

2.7. The wing integral fuel tanks had also been assembled using the same polyester faying surface sealant as in the fuselage tanks, however a silicone sealant rather than the polysulphide sealant was used for the fillet seal because silicone had better heat stability and was more flexible. While the polyester sealant 'reverted' and had the same hydraulic effect on the fillet seal as it had had in the fuselage tanks, it seems there was not the same chemical reaction with silicone as there was with the polysulphide sealant. Nonetheless, almost inevitably, the wing integral fuel tanks also reached the point where ad hoc fuel leak repairs became very time consuming and relatively ineffective. This collective realisation was documented by 482SQN in July 1981. A wing deseal/reseal program was consequently developed and finally trialed by 3AD in 1985. The wing program then continued at 3AD through to 1992. Wings were worked on in pairs and twenty-four sets were processed through the program. The tanks were able to be completely opened by removing the top skin (one machined piece) hence work was conducted from outside the tank. Chemical desealants were not used in the process because of concern for the D6AC steel wing pivot fittings and the fuel tank paint. In any case, SR51 was not effective on the fluorosilicone fillet sealant therefore an alternative product needed to be proven. The USAF used PR3107 for a period to chemically deseal wings.

2.8. Although the fuselage desealing process had been thorough and an epoxy barrier had been applied to separate the faying surfaces from the new polysulfide sealant bead, continued breakdown of the faying surface sealant meant fuel leaks recurred and worsened to the point where a second fuselage deseal/reseal program became necessary. This might also have been influenced by less than perfect application techniques on the first program that resulted in low bond strength of the barrier, and to poor condition of the fuel tank paint. This second program was contracted to Hawker de Havilland (Victoria) (HDH) who performed the work to RAAF specifications within RAAF Amberley facilities. As well, as with the first program, some aircraft were processed through the USAF facilities at SM-ALC if they were on site for other maintenance or modification work. An important variation from the first fuselage program was that the chemical phase of desealing was no longer specified; high-pressure water guns were used as the principal desealing method. Seventeen aircraft were processed through this second program by HDH between April 1991 and August 1993. Five aircraft were processed through SM-ALC between March 1990 and March 1994. Subsequent to this second program, fair debate ensued over warranty claims on HDH because aircraft not long out of DSRS were again leaking. However, the same applied to aircraft that had been processed through SM-ALC.

2.9. While not forming part of the wing and fuselage programs, through the early to mid 1980's there were also maintenance programs for vent tanks and weapons bay tanks. The procedures used on these tanks were to all intents and purposes the same as those used on the wings. (This work included a number of weapons bay tanks being repaired by contractor Godfrey Howden during 1985/6.) Also, individual fuselage fuel tank repairs continued at 3AD/501WG, as required, either side of the two fuselage deseal/reseal programs, though not to the extent that warranted a full aircraft program. The conditions of employment nevertheless would have been very similar to those experienced during the second program, with the exception of the extent of use of the hydrolaser. These activities have not been formally reviewed as part of this Inquiry; nonetheless, conclusions and recommendations, by extension, relating to general aircraft integral fuel tank maintenance are applicable.

2.10. In 1992, the USAF adopted a process that very much simplified the repair of F-111 fuselage tanks. This process originally specified water pick desealing and cleaning before spray application of the sealant. However, the first couple of applications resulted in many air pockets with consequential time consuming patch-up penalties. Desealing by water pick ceased, and was replaced by patch repairs, thorough alkaline and hot water washes, and drying. Therefore, instead of the laborious task of desealing to remove all of the old sealant, or repairing localised areas with hope that all sealant delaminations had been covered, the task was now simply to spray new flexible polythioether polyurethane sealant (with primer) over the old MIL-S-83430 polysulphide sealant. While there was a level of confidence that this method would prove more effective than previous schemes, the great benefit was that the repair time for each aircraft was reduced to an average of two weeks compared with the previous twenty plus weeks for a full deseal/reseal. The spray seal process was successfully trialed by 501WG in 1996 and subsequently introduced as the approved repair scheme. It is this process that was suspended in January 2000. It has been applied to various tanks of thirteen aircraft, six of which are G models that were acquired from the USAF in 1993/4.

2.11. The RAAF is planning to retain the F-111 in service for up to twenty years more and integral fuel tank leaks remain problematic; they continue to represent a significant ongoing threat to aircraft availability. An inherently safe and more effective and enduring means of resealing tanks needs to be developed with some urgency. At point of writing, localised pick and patch repair techniques were being employed to repair leaking fuel tanks and a task has been given to contractors to review the whole fuel leak problem.

CHAPTER 3 - THE FIRST DESEAL/RESEAL 1977 – 1982

PLANNING AND TECHNICAL PROCESS SOURCING

3.1. At the direction of Air Force Office (DEFAIR), RAAF Headquarters Support Command (HQSC) was directed to begin planning for an F-111 fuselage fuel tank Deseal/Reseal (DR) Program to commence by mid-1976[1].

3.2. HQSC Aircraft Engineering Section 1D (AIRENG1D) contacted the Technical Liaison Officer (TLO) at the USAF Sacramento Air Logistics Centre (SM-ALC) to obtain information on the F-111 deseal/reseal program being conducted by the USAF. The TLO was tasked to gather as much information as possible on the program[2]. This information was communicated in numerous detailed technical reports[3], and quarterly status reports[4]. The office also represented RAAF in discussions with Eldorado Chemical Company (herein after referred to as Eldorado)[5].

Expert Consultancy

3.3. The Materials Research Laboratory (MRL) in Melbourne was also asked to provide expert advice on technical aspects of the proposed program and design solutions[6]. The MRL Task Manager for Air Task 75/03 (Research and Investigation Program on Current and New Materials for Aircraft Sealants, sponsored by AIRENG1D) became actively involved, visiting Amberley, General Dynamics Fort Worth Division (GD/FW), and SM-ALC.

Safety Policy

3.4. A key element of the USAF process was the use of a chemical desealant called SR51, manufactured by Eldorado. The HQSC Hygiene Officer (CHYGO) was asked to give an independent opinion of the toxicity of this chemical softener[7]. A preliminary evaluation identified Threshold Limit Values (TLV) of the component chemicals and recommended PPE, safety equipment and First Aid procedures. The conclusion was drawn that the toxicity of SR51 was greater than that suggested by Eldorado Chemical, but less than the estimate of the USAF, the debate centering on the type of naptha used and its benzene content[8]. This is of significance as much of the later focus on toxicity of SR51 involved thiophenol, to the detriment of precautions against naptha. The CHYGO later recommended that all polymer adhesives and sealants should be considered as potentially hazardous substances until more detailed information was available, and handled accordingly[9].

Planning Meetings

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1 CBR.0027.152, F111C Fuel Tank Sealant Reversion; 16 Oct 75.

2 LAV.0018.019, Message Form; 9 Jan 76 and LAV.0018.087, F111C Fuel Tank Deseal/Reseal Program; 24 Jun 76.

3 LAV.0016.009, F111C Project Integral Fuel Tanks Deseal/Reseal Program; 12 Mar 76 and LAV.0016.092, F111C Project Integral Fuel Tanks Deseal/Reseal Program; 22 Oct 76 and LAV.0027.068, F111C Project Integral Fuel Tanks Deseal/Reseal Program; 31 Jan 77 and LAV.0027.277, F111C Deseal/Reseal SM-ALC Process Order for Control of Turco 5555H; 27 May 77 and LAV.0027.248, F111C Fuel Tank Deseal/Reseal Procurement and Process Specifications for Chemical Desealer and Alkaline Rinse; 28 Jun 77.

4 LAV.0006.173, Quarterly Report RAAF Technical Liason Officer; 4 Oct 76 and LAV.0006.156, Quarterly Report RAAF Technical Liason Officer; 6 Jan 77 and LAV.0006.141, Quarterly Report RAAF Technical Liason Officer; 20 Oct 77.

5 LAV.0016.008, F111C Deseal/Reseal Program; 19 Mar 76 and LAV.0018.040, Deseal of F111C Aircraft; 27 Feb 76 and LAV.0016.049, F111C Deseal/Reseal Program Services Required from Eldorado Chemical Company; 20 Dec 76 and LAV.0003.237, F111C Fuel Tank Deseal/Reseal – Status of Contract with Eldorado Chemical Company; 15 Mar 77 and LAV.0027.289, F111C Fuel Tank Deseal/Reseal – Proposed Contract with Eldorado Chemical Company; 27 May 77.

6 LAV.0018.013, Visit to RAAF Base Amberley; 20 Nov 75 and LAV.0018.033, Materials for F111C Fuel Tank Deseal/Reseal Program; 4 May 76.

7 LAV.0001.107, 2601/8/108/ PT2 (52), F111C Fuel Tank Deseal/Reseal Program; 10 Jun 76.

8 LAV.0001.103, 1804/40/1/2/MED (2), Eldorado Stripper SR51; 18 Aug 76.

9 LAV.0005.121, 1804/40/5/MED Pt1 (17), Monitoring of Personnel – The Use of Sealants; 13 Dec 77.

3.5. The status of the planning process was reported in frequent meetings discussing the DR Program[10]. These were chaired by HQSC Repair and Overhaul Division officers, and attended by representatives of other HQSC divisions as well as elements of DEFAIR, 3AD, the Commonwealth Department of Construction (DOC) and MRL.

Initial Training

3.6. From the information gathered by the TLO, the documented USAF procedure did not fully define all the work involved. RAAF personnel were therefore selected to undergo on-the-job training at SM-ALC. Two SNCOs and three NCOs were attached to SMALC for OJT between April and July 1977 and they returned to 3AD to instruct and supervise the workforce for at least the prototype aircraft A8-126. While at SM-ALC, the FSGT acquired a copy of an instructional film.

3.7. The FSGT produced fortnightly reports including comment on: training; ground support equipment requirements; procedures and drawings; quality control standards and implementation; spares – Bill of Materials; interface with other depot level maintenance programs; status of USAF supplied equipment; and safety aspects[11]. Ultimately, a draft procedure for the RAAF DR program was developed[12].

RAAF Developed DR Procedures

3.8. GD/FW produced a USAF *Aerospace Equipment Instruction*, dated June 1975[13], describing the repair method. Further details of the chemical deseal were contained in a complementary report[14].

3.9. The draft RAAF procedure was developed through the conversion of the GD/FW process specification 12AEI-200-1060. Other USAF orientated procedures were adopted taking into account RAAF trade structure and maintenance procedures[15].

3.10. The first DR program was treated as an aircraft modification and assigned F111C aircraft modification No 292. Based on the USAF DR procedures, the modification order was developed by AIRENG1D and the ensuing modification order promulgated on 19 April 1978[16]. This procedure was used until the modification instruction was repromulgated by AIRENG1D as DI (AF) AAP 7214.003-292-1, Deseal/Reseal of F111C Fuselage Fuel Tanks (292-1), on 5 December 1979.

3.11. In addition to the 292-1, two other publications were concurrently issued: DI (AF) AAP 7214.003-292-2, Deseal/Reseal of F111C Fuselage Fuel Tanks, Work Sheets (292-2), and 7214.003-292-3, Deseal/Reseal of F111C Fuselage Fuel Tanks, Health and Environment, Quality Control and Operating Instructions for Deseal Unit (292-3). The three publications together prescribed all mandatory working procedures, test and inspection requirements, materials, PPE, quality control and equipment operating instructions for the First DR Program. A description of each publication is shown in Table 3.1:

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10 LAV.0018.123, F111C Fuel Tank Deseal/Reseal Program – Technical Committee Meeting; 13 Sep 76 and AMB.0055.042, Agenda for a Meeting on the F111C Fuel Tank Deseal/Reseal Program; 20 Oct 76 and LAV.0016.055, F111C Deseal/Reseal Facility Planning Conference RAAF Base Amberley 8-11 Nov 76 and MRL.0001.237, Disposal of Waste SR51; 17 May 77.

11 LAV.0003.206, F111 Fuel Tank Deseal/Reseal NCO I/C Report 2; 15 Apr 77 and LAV.0003.189, F111 Fuel Tank Deseal/Reseal NCO I/C Report 3; 23 Apr 77 and LAV.0027.283, F111 Fuel Tank Deseal/Reseal NCO I/C Report 5; 27 May 77 and LAV.0027.255, F111 Fuel Tank Deseal/Reseal NCO I/C Report 6; 17 Jun 77.

12 LAV.0027.184, F111C Deseal/Reseal Procedures and attachments; 19 Jul 77.

13 MRL.0018.022, General Dynamics 12AEI-200-1060, Fuselage Fuel Tank Deseal/Reseal Procedures; 12 Jun 75.

14 CBR.0027.154, Fuel Tank Chemical Deseal Demonstration – Final Engineering Report; 20 Oct 75.

15 LAV.0027.080, F111C Fuel Tank Deseal/Reseal Draft Procedure; 26 Jan 77.

16 AMB.0062.095, F111C Fuel Tank Deseal/Reseal; 19 Apr 78.

Table 3.1: Description of RAAF F111 Deseal/Reseal Procedures[17]

Publication Number	Title	Description
DI(AF) AAP 7214.003-292-1	Deseal/Reseal of F111C Fuselage Fuel Tanks, Procedure	Contains detailed working procedures of each stage of the DR operation from aircraft preparation through to test flight
DI(AF) AAP 7214.003-292-2	Deseal/Reseal of F111C Fuselage Fuel Tanks, Work Sheets	Contains a sequential organised set of working instructions which were used to maintain a permanent record of work completed, and obtain the appropriate test and inspection signatures
DI(AF) AAP 7214.003-292-3	Deseal/Reseal of F111C Fuselage Fuel Tanks, Health and Environment, Quality Control and Operating Instructions for Deseal Unit	Lays down in detail procedures for the protection of personal health and the environment, quality control of the materials used, and a description of the deseal facility and its operation

3.12. Few amendments were made to these publications during the first DR program. Amendment List (AL) 1 of the 292-1, dated June 1981 introduced a third circulation of SR51 to the deseal procedure, while AL2 dated August 1981 removed Chapter 20, Test Flight and Pre and Post Flight Fuel Filter Checks[18].

Facilities

3.13. The desealing process produced highly noxious odours and flammable fumes and therefore required a separate facility to shelter the aircraft and the desealing equipment, isolated from the main domestic/maintenance areas of Amberley where the desealing work was to be conducted. The preparation and resealing activity was scheduled for general maintenance hangars, buildings 410 and 277[19].

3.14. An Air Force Works Requirement (AFWR) was produced on 12 August 1976 describing the activities to be accommodated, the facility to be provided, and the environmental impact. To account for leaks of desealant from the fuel tanks and system plumbing; a closed drainage system capable of collecting the gross amount of chemical was required. A standard transportable hangar, with a concrete floor, incorporating a closed drainage system was recommended[20]. This requirement was expanded to include the need for:

a. safety deluge showers;
b. breathing-air supply;
c. facilities to wash clothing used in the DR process;
d. standard signage for hazardous areas; and
e. environmental control of spills[21].

3.15. The Commonwealth Department of Construction built the deseal facility (Building 661, Figure 3.1), commonly known as the 'Rag Hangar'. The work was completed on 12 December 1977. It was a canvas-covered, air transportable hangar erected over a fully drained and reinforced concrete floor. The drainage system was designed to handle the spillage of chemicals and alkaline cleaning compounds. Fresh water, pressurised air, and electrical power were all available. All floor drainage entered a chemical separator dam, located approximately 200 metres to the south of the Deseal Facility[22].

17 HDH.0006.021, DI(AF) AAP 7214.003-292-1, Deseal/Reseal of F111C Fuselage Fuel Tanks Procedure; 5 Dec 79.
18 PUB.0001.001, DI(AF) 7214.003-292-1, Amendment Lists.
19 WIT.0356.001, Witness statement of Colin James Ramsay at par 6(i).
20 LAV.0018.115, AF 463/5/166 (3), F111C Fuel Tank Deseal/Reseal Facility at RAAF Base Amberley; 12 Aug 76 and AMB.0055.045, F111C Fuel Tank Deseal/Reseal Facility at RAAF Base Amberley; 12 Aug 76.
21 LAV.0016.055, 2506/38/6/Tech 2(24) HQSC, F111C Deseal/Reseal Facility Planning Conference and attachments; 8 Nov 76 and LAV.0003.258, AF463/5/166, F111C Deseal/Reseal Facility Planning Conference and attachments; 1 Jan 77.
22 HDH.0007.228, AAP 7214.003-292-3, Deseal/Reseal of F111 Fuselage Fuel Health and Environment Quality Control and Operating Instructions for Deseal Unit; 5 Dec 79.

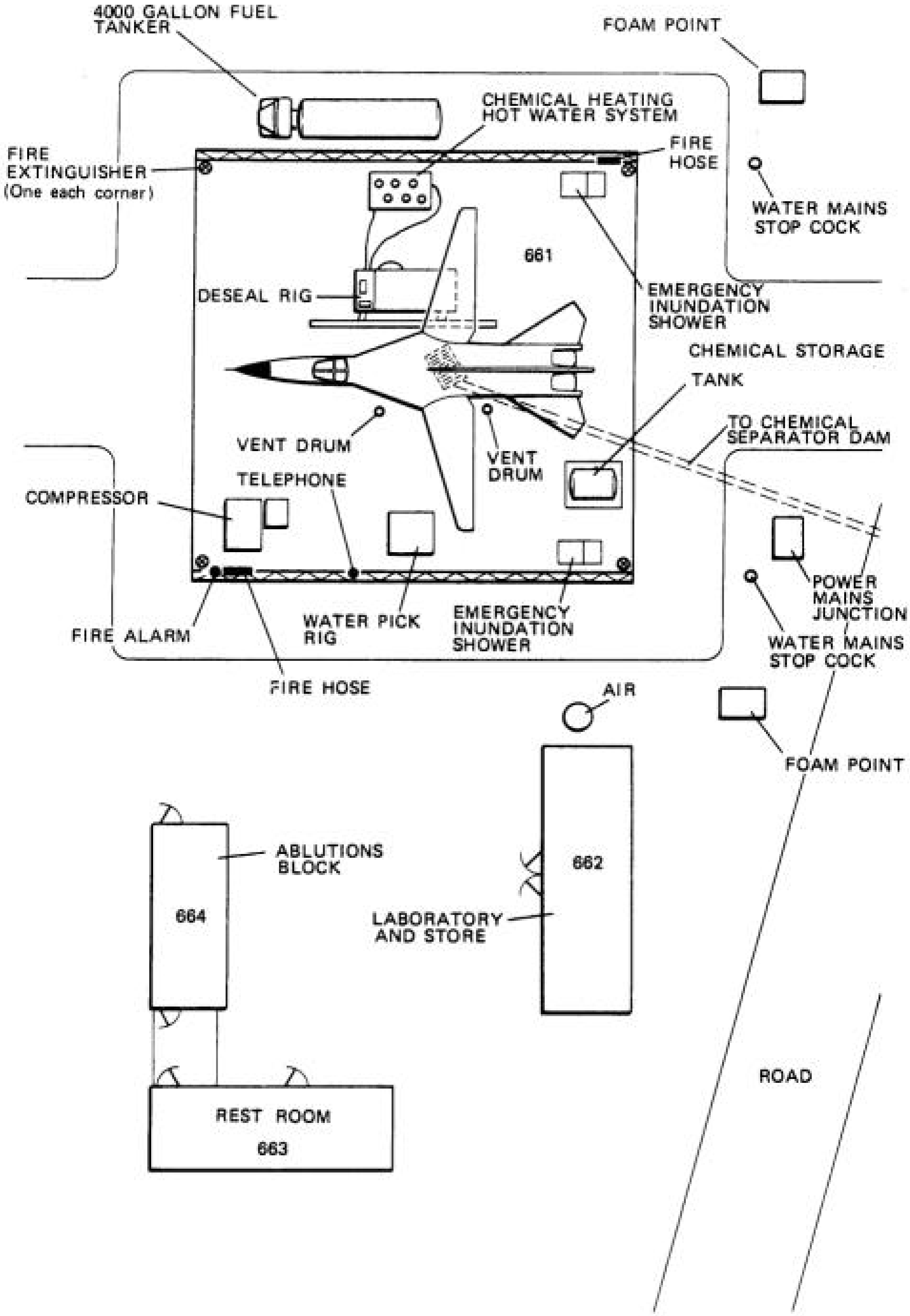

Figure 3-1: Layout of Building 661 Deseal Facility (Rag Hangar)[23]

Prototype Deseal/Reseal

3.16. On 13 October 1977, disassembly of F111C A8-126 commenced in preparation for the prototype RAAF DR. An Eldorado Field Service Representative arrived on 15 November 1977 to provide training in the use of the desealing rig and remained on site for approximately 12 months. The aircraft was moved into the deseal facility ('Rag Hangar'), which was completed on 12 December 1977 and the build-up of manifolding and plumbing of the Eldorado equipment began.

3.17. Commencing on 4 January 1978, the chemical deseal of the forward tanks and the water-picking (hydro-lasing) of the engine bay area began concurrently. The chemical deseal and the

23 HDH.0007.228, (at 271) AAP 7214.003-292-3, Deseal/Reseal of F111 Fuselage Fuel Health and Environment Quality Control and Operating Instructions for Deseal Unit; 5 Dec 79.

ED500 rinse of the forward tanks was completed on 6 January 1978. Water picking then began on the forward tanks, while the chemical deseal of the aft fuselage tanks was being carried out.

3.18. Once the chemical deseal of the aft tanks was completed, they were rinsed with ED500, while the water picking of the forward tanks was also completed. Massive leaks from the saddle tank dummy panels were detected, which resulted in the chemical pressure lines to those tanks being shut down. Some desealing action did continue due to the SR51 vapour vented into the saddle area from the sprinklers in the aft tanks. Laborious hand cleaning was performed on the saddle tank to remove the remaining sealant.

3.19. The deseal plumbing was removed from the aft fuselage so that the water-picking of the aft tanks could begin on 10 January 1978. By 15 January 1978, the water-picking phase was finally completed and all of the fuel tanks were flushed, vacuumed and dried.

3.20. The hand-cleaning phase for the remainder of the aircraft began on 16 January 1978, although the process was hampered by a lack of suitable equipment (for example, cleaning brushes and inspection lights). The hand cleaning progressed past 30 January 1978, when the aircraft was returned to the E-servicing area[24]. Aircraft A8-126 needed to be returned to service as soon as possible, to allow for prototype reconnaissance modifications to be performed in Fort Worth.

3.21. The reseal stage escalated to a three-shift program, with two shifts applying sealant, and one midnight to dawn shift monitoring sealant curing GSE, sealant testing and preparing equipment[25]. 3AD found only one structural leak and repaired it before completion. Four leaks from plumbing and/or equipment fittings were discovered later. This procedure was relatively successful compared to USAF results[26]. The aircraft was delivered to 482SQN on 30 May 1978, with a time-to-make serviceable (TMS) of 21 weeks.

The First Program

3.22. After the prototype fuselage DR was successfully completed on aircraft A8-126, the remainder of the F111C fleet was scheduled for the program. The completed program dates and locations are included in Table 3.2 Eleven aircraft were completed at 3AD however, owing to resource constraints and the concurrent imperative to complete cold-proof load testing (CPLT) on the fleet, nine aircraft were put through the DR program in America at McClellan AFB. SM-ALC technicians conducted the resealing and cold-proof load testing, and Eldorado working under a USAF contract performed the desealing. For the nine aircraft processed for deseal/reseal through SM-ALC, the work procedures were as specified for USAF aircraft in Time Compliance Technical Orders (TCTO) 1F-111-1162 and 1172. This arrangement was agreed by letter of offer and acceptance AFLCR 66-67 and 65-17. Four attrition F111A aircraft were acquired in 1981 with the DR of these aircraft occurring while in USAF service.

3.23. The aircraft repaired overseas were not considered further by this Inquiry.

Table 3.2: F111C First Deseal/Reseal Program

Tail No.	**Date in**	**Date Out**	**DR Location**	Notes
A8-126	Oct 77	May 78	3AD	1, 2
A8-128	Jun 78	May 79	3AD	4
A8-129	Aug 78	May 79	3AD	3
A8-125	Dec 78	Mar 80	3AD	3
A8-127	May 79	Apr 80	3AD	4
A8-130	May 79	Jun 80	3AD	4
A8-131	Jan 80	Sep 80	3AD	
A8-132	Jul 80	Nov 81	3AD	4
A8-135	Jan 81	Jun 81	3AD	
A8-142	May 81	Sep 81	3AD	
A8-134	Jul 81	Feb 82	3AD	2, 5

24 LAV.0002.113, Prototype Deseal/Reseal: Progress Report; 9 Feb 78 and LAV.0002.116, Prototype Deseal/Reseal: Work Progress; 9 Feb 78.

25 LAV.0005.215, Minutes of the Maintenance Management Committee Meeting at No 3 Aircraft Depot; 12 May 78.

26 LAV.0002.059, Minutes of F111C Deseal/Reseal Meeting at 3AD; 31 Jul 78.

A8-139	Sep 81	Jan 82	SM-ALC	6
A8-143	Oct 81	Jan 82	SM-ALC	2, 6
A8-146	Dec 81	Apr 82	SM-ALC	2, 6
A8-148	Dec 81	Mar 82	SM-ALC	6
A8-145	Jan 82	Jul 82	3AD	
A8-147	Feb 82	May 82	SM-ALC	6
A8-138	Mar 82	May 82	SM-ALC	6
A8-140	Apr 82	Jun 82	SM-ALC	6
A8-144	Jun 82	Dec 82	SM-ALC	6

Notes:

1. Prototype Deseal/Reseal conducted on this aircraft.
2. Aircraft converted to RF111C in 1980.
3. Deseal/Reseal combined with CMTC[27].
4. Deseal/Reseal combined with CMTC and E-servicing[28].
5. Deseal/Reseal combined with E-servicing.
6. Deseal/Reseal combined with Cold-Proof Load Testing[29].

The Deseal/Reseal Process

3.24. The fuselage Deseal/Reseal was time-consuming and resource intensive. The work was carried out in one, two or three shifts depending on the work to be done, with a typical time-to-make serviceable (TMS) of 26 weeks[30]. TMS ranged from 28 weeks for earlier DR activities and 15 weeks for later operations[31]. Table 3.3 shows typical workforce requirements for a 26-week fuselage Deseal/Reseal.

Table 3.3: Workforce Requirements for a 26 week TMS[32]

Activity	Work days	Shifts	Manhours	Total AFFITTS		
				LAC	CPL	SGT
Aircraft preparation	10	2	882	15	6	3
Chemical deseal/water-pick	12	3	1 260	15	6	3
Hand clean	30	1	2 520	15	4	3
Barrier application	10	1	1 200	15	4	3
Sealant application	30	1	1 800	15	4	3
Plumbing in	14	1	621	15	6	3
Air (dry) checks	2-5	1	240	8	2	1
Fuel (wet) checks	2-5	3	240	5	2	1
Rebuild, functionals, paperwork, FOD, independent inspection	25	1	2 240	5	2	1
Total			11 003			

3.24 In addition to the hours worked by airframe fitters (AFFITTS) shown in Table 3.3, surface finishers required one week for tank repaint, aircraft metalworkers required one week for repairs, electrical fitters required several hours for component removal and refitting, and non-destructive inspection technicians required a variable number of hours for sealant quality control and panel inspection. DR was usually conducted with other depot level aircraft work (See the notes to Table 3.2). These figures notwithstanding, most aircraft cost 18,000-20,000 manhours. This compares unhealthily with an initial planning estimate of 5,500 hrs and USAF quoted figures of 7,000 hrs per aircraft.

3.25. AAP 7214.003-292-1 describes the steps in the DR process. A simplified list is:

27 LAV.0005.252, Crew Module Time Change, which is a complete change out of all live explosive items in the F111 egress system (conducted every 4 years); 9 Apr 80.

28 'E' servicing is the deepest level of RAAF F111 routine servicing, conducted by 3AD: now known as the R5 servicing (conducted every 1500 airframe hours).

29 Cold-proof load testing, where the entire aircraft is subjected to low temperatures and cycled loads then applied to the aircraft. Conducted at McClellan AFB, CA and managed by SM-ALC (conducted every 2000 airframe hours).

30 LAV.0013.053, F111C Fuel Tank Deseal/Reseal Program; 6 Aug 80.

31 LAV.0016.148, F111 Fuel Tank Deseal/Reseal at No 3 Aircraft Depot; 17 May 89.

32 LAV.0013.053, F111C Fuel Tank Deseal/Reseal Program; 6 Aug 80 and LAV.0016.148, F111 Fuel Tank Deseal/Reseal at No 3 Aircraft Depot; 17 May 89.

a. the aircraft to be defuelled and purged;
b. removal of multiple access panels and masking of antennas, seals, composite panels, WCTB, etc;
c. depuddling and further purging as required, and removal of fuel system components and plumbing from the tanks, the work being conducted in a general maintenance hangar (hangar 277);
d. transfer of the aircraft to the ‘rag hangar’;
e. installation of the desealant sprinkler system within the tanks and temporary tank closure;
f. sprinkling/circulation of heated SR51 for 24 hours to soften and break down existing sealant;
g. checking the degree of sealant removal and security of the sprinkler system, then repeat sprinkling for a second 24 hour period, (and repeated a third time for about the last four aircraft);
h. rinsing of the residue SR51 and any loose sealant from the tanks, using heated water based alkaline cleaner, ED500, in proportions of 1:3 water, for one hour;
i. rinsing of the tanks with hot, clean fresh water until a pH reading of between 7 and 9 was achieved;
j. opening of the tanks to depuddle remaining water by suction hose;
k. removal of the desealant sprinkler system;
l. removal of softened sealant by water pick/hydro laser (high pressure water jet at 7,500 psi) plus the sealant from those tanks not sprayed with SR51 – i.e. finger, saddle, upper and lower trap tanks;
m. rinsing tanks using ED500 alkaline cleaner in proportions of 1:3 water, then drying;
n. returning the aircraft to a general maintenance hangar (hangar 277 or 410);
o. alternately scrubbing remnant sealant with scotchbrite and MIL-C-38736 solvent, and hand picking using dental picks;
p. injecting Proseal 899/PR1750 sealant into injection seams to eject as much reverted polyester sealant as possible from faying surfaces;
q. rinsing tanks as per step m and drying;
r. removal of loose fuel tank paint and chemically treating exposed aluminium with chromate conversion coating (alodine);
s. painting chemically treated areas plus all voids/seams which were to have epoxy barrier and sealant applied, using polyurethane paint conforming to MIL-C-27725;
t. filling all voids with epoxy void compound XA3598 using fillet guns;
u. wiping all surfaces clean with MIL-C-38736, priming with PR148 adhesion promoter and wiping dry, then applying a two part epoxy barrier by fillet gun and spatula along seams and around fasteners to isolate new sealant from the residue polyester faying surface sealant, and allow to cure for a minimum of 24 hours;
v. wiping all surfaces clean firstly with MIL-C-38736 and secondly with PR148 sealant adhesion promoter;
w. applying a first coat of MIL-S-83430 type A sealant by brush and allowing 24 hours curing to tack free state (note: the first five aircraft used Proseal 899 but quality control problems then forced adoption of PR1750, and PR1750 also had the benefit of being less susceptible to reverted polyester sealant);
x. preparing the partially cured sealant surface using MIL-C-38736 solvent, and applying a second and final coat of type B sealant using fillet guns and applicators;
y. reinstalling finger and saddle tank fixed panels using MIL-S-83430 on faying surfaces;
z. leak testing using compressed air (5 psi), re-installing fuel system plumbing and components, and re-closing fuel tanks for fuel system checkout and fuel flush; and
aa. weigh and return the aircraft to hangar 410 or to flightline for refuelling.

Access Control

3.26. The hazardous nature of SR51 dictated that access to the deseal area was to be restricted. The need for a restricted area was identified early in the development of the DR program. The 292-3 stated:

a. ‘Access to the deseal area is to be controlled by means of barricades and warning signs which are to be in effect during SR51 desealing and alkaline rinsing operations. Only those personnel directly involved in the performance or testing of the SR51 desealing or alkaline rinsing process are to be allowed in the deseal area.[33]

EQUIPMENT

Deseal Rig

3.27. The deseal rig consisted of a two compartment steel tank with a capacity of 4 000 litres. A manifold was run through the bottom of the tank for fluid heating. One of the pumps fitted to the end of the rig had a capacity of approximately 900 litres per minute and was used to pump chemical and rinse material through the aircraft. The second pump was used to pump water for hosing out the fuel tanks after the deseal and alkaline rinses.

3.28. Two manifolds were run along the side of the rig. The lower one connected directly with hoses to the sprinkler system installed in the aircraft fuel tanks. The upper manifold acted as the return system from the fuel tanks to the deseal rig. All chemicals and other fluids passed through two filters, the first was installed between the pressure manifold and each individual sprinkler system, and the second was a gauze screen installed between the two compartments of the rig tank[34].

3.29. While the SR51 was being recirculated through the aircraft fuel tanks, one man was to remain in the hangar on rig watch. The intention was that this person was to observe the deseal operations and monitor the temperature, pressure, rig chemical level, and vacuum scavenge system. All hoses, fittings, and blanks fitted to the tanks were to be regularly inspected for signs of leakage[35].

Chemical Heating System

3.30. This system was used to heat chemical and alkaline rinse fluids for pumping through the aircraft fuel tanks and was activated at the hangar wall. The chemical heating system consisted of six Rheem hot water units, two pumps, and two water manifold systems. The system was connected to the deseal rig using two hoses; one for hot water supply and the other return. The six hot water units were switched on and off automatically in order to maintain a preset temperature[36].

Water-Picking Rig

3.31. The water-picking rig consisted of a control panel, an electric motor driving a high-pressure pump, a water supply reservoir and two water-pick guns. A pressure gauge was mounted on the pump, and the maximum operating pressure was 7500 psi to each gun. When the trigger was pulled on either gun, water at a pressure of 7500 psi was forced out of the nozzle, and when the trigger was released, the water was exhausted through a bypass valve in the gun, draining through a bypass hose and onto the floor. In an emergency, the EMERGENCY OFF switch on the control panel was to be actuated. The high-pressure pump was fitted with a relief valve set to release at approximately 8500 psi and was lubricated with water from the reservoir[37].

3.32. The two water-pick guns were operated simultaneously. A minimum of three men were required to use one gun, one was the gun operator, the second his attendant who was to supply clean visors or goggles and rearrange the gun hoses, and the third was the water-picking rig operator. A minimum of five men were required to operate two guns, consisting of two gun operators, two attendants and one rig operator. In an emergency, the attendant was to signal the rig operator who was to close down immediately. The person operating the water-pick gun was to wear protective clothing at all times, including a face shield or an air mask, and was to keep all parts of his body behind and away from the spray nozzle[38].

TRAINING

3.33. The DR process contained a number of areas that required training.

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33 PUB.0004.001 (at 034), DI(AF) 7214.003-292-3; at pars 113-114.
34 HDH.0007.271, AAP 7214.003-292-3; 5 Dec 79, Chapter 3 at par 308.
35 HDH.0007.271, AAP 7214.003-292-3; 5 Dec 79, Chapter 3 at par 311.
36 HDH.0007.271, AAP 7214.003-292-3; 5 Dec 79, Chapter 3 at par 313.
37 HDH.0007.271, AAP 7214.003-292-3; 5 Dec 79, Chapter 3 at par 310.
38 HDH.0007.271, AAP 7214.003-292-3; 5 Dec 79, Chapter 3 at par 314.

Hazardous Substance Training

3.34. Hazardous substance training was required to give personnel information needed to use chemicals safely. The training requirements for the use of chemicals is contained in AAP 7214.003-292-3 at par 122, which states:

> 'All personnel working on deseal operations are to be instructed as to the toxicity and the pollution hazard of SR51. Personnel are to ensure that they understand the applicable fire, health and safety precautions and actions to be taken in the event of a chemical spillage as described herein.39' This requirement only refers to the use of SR51, however, there were other hazardous substances used in the DR process, especially 'Mil-Spec' (MIL-C-38736) solvent and PR-148 primer. These and other chemicals, the respective hazards and control measures necessary to reduce risk were not included.

3.35. The short film on the DR procedures obtained from the USAF mentioned by some witnesses, focussed on the various product applications and some physical hazards, particularly the water-pick. No detailed information was included about the hazardous nature of the chemicals used.

Confined Space Entry Training

3.36. No Australian Standard for Confined Space Entry (CSE) training existed at the time of the first DR. An American National Standards Institute (ANSI) document titled Safety Requirements for Working in Confined Spaces of 1977[40], was apparently not known, hence no CSE training was prescribed.

Deseal/Reseal Process Training

3.37. There was no formal requirement to conduct training on the DR process. Training was mainly conducted informally, on-the-job under supervision. This was broadly accepted as being adequate for the purpose.

DISPOSAL OF SR51

3.38. One specific aspect of chemical management warranting comment is the means of disposal of SR51. This process was poorly specified and supervised and was a serious cause of exposure for those tasked with disposal. Several waste products containing SR51 were generated and required disposal. These products were:

a. spilt SR51 from tank leaks, disassembly of sprinkler systems, filling and emptying of the deseal rig;
b. unused, time-expired SR51;
c. used SR51 from the deseal process (containing dissolved polysulphide sealant);
d. alkaline rinse solution, comprising up to 30% SR51 (by exception), ED500 alkaline cleaner and water; and
e. clear water rinse solution containing small quantities of organic materials (SR51, ED500 and sealant)[41].

USAF Disposal Method

3.39. The USAF contracted Eldorado to dispose of waste desealant as part of their contract to deseal the USAF F111 fleet[42]. The USAF solution was to have Eldorado barrel the waste SR51 for recovery by distillation, and the alkaline and water rinse solutions to be collected and treated with dilute aqueous sodium hypochlorite to destroy residual thiophenol, the active component of SR51[43].

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39 HDH.0007.228 (at 237), AAP 7214.003-292-3; 5 Dec 79.
40 ANSI Z117.1-1977, Safety Requirements For Working in Confined Spaces, referred to in AS 2865:1986.
41 LAV.0016.053, F111C Fuel Tank Deseal/Reseal – Disposal of Waste Desealer and Rinse Solutions; 2 Dec 76.
42 LAV.0018.011, Comments on F111 Fuel Tank Deseal/Reseal Procedures; 30 Jun 75.
43 MRL.0004.326, Paul D B, *The USAF Deseal-Reseal Program for F111 Fuselage Fuel Tanks*. Report on Visit to USA; 17 Jan-10 Feb 76, Materials Research Laboratories at page 16-17.

RAAF Method Developed

3.40. In November 1975, the MRL Task Manager visited RAAF Amberley, before visiting SM-ALC to observe US DR practices[44]. At the time of his appointment, the Task Manager's expertise was in the chemistry of polysulphide sealants. As an organic chemist specialising in sealants, he was conversant with the mechanisms of sealant degradation and curing, as well as with mechanical and physical properties of aircraft sealants, as shown in several reports co-authored by him[45].

3.41. In commenting on the USAF Procedures[46], MRL advised the RAAF to seek advice on SR51 composition and disposal procedures. In May 1976, DEFAIR was briefed on aspects of the USAF procedures and the requirements for safe disposal, drainage and special works for a RAAF program were discussed. The preference was for the RAAF to adopt USAF procedures and only alter them if local difficulty was encountered. MRL was asked to recommend suitable methods[47], noting that the Victorian EPA had advised that the only acceptable means of disposal were burning or reclamation by distillation[48].

3.42. In November 1976, MRL proposed a procedure for disposal of used SR51, alkali rinse and water rinse solutions based on discussions held with Eldorado, the Victorian EPA and various fire officers[49]. The proposed method (which was eventually adopted by the RAAF) was to pre-treat SR51 waste solutions with a 1% aqueous sodium hypochlorite solution, which converted the thiophenol component of SR51 to a more benign, yet still toxic phenyl disulphide[50]. The mechanism of this reaction was documented in an MRL report[51]. Products of this reaction are polysulphide solid/sludge, aqueous solution and Naphtha. The disposal methods for each by-product are listed in the following table:

Table 3.4: Disposal Methods Recommended by MRL[52]

By-Product	Recommended Disposal Method
Aqueous solution	Poured down drains followed by water flush
Polysulphide sludge	Air-dried then disposed as solid waste or buried
Naphtha	Burning
Alkaline rinse solution	Treat as SR51 - ED500 will be in aqueous solution
Final Water rinse	Dispose down drains

3.43. A planning Conference on 18 and 19 April 1977, discussed methods of disposal, including incineration, a DOC suggestion of burning in the separator dam, and burning in open metal trays[53].

3.44. In May 1977, The Office of Environment Protection with the Commonwealth Department of Environment, Housing and Community Development conditionally accepted the proposal for disposal provided the naphtha incineration avoided the production of dark smoke. They recommended a two-stage incinerator or an air-blast fire pit[54].

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[44] LAV.0018.010, Visit to RAAF Base Amberley by Dr D B Paul; 24 Nov 75.

[45] MRL.0016.461, Barber, J.W. et al, *Effect of Temperature on the Storage Life of Polysulphide Sealants*, MRL Technical Report MRL-TR-89-31; Aug 89 and MRL.0016.393, Barber, J W et al, *Studies of the Effects of Sub-Zero Storage Temperatures on the Properties of Pre-Mixed Polysulphide Sealants*, MRL Technical Report MRL-R-656; Oct 80 and AMB.0095.001, Hanhela, P J and Paul, D B, *Interactions Between F111 Fuselage Fuel Tank Sealants. Part 1 Characterisation of Polyester Sealants and their Hydrolytic Degradation Products*, MRL Technical Report MRL-R-657; Dec 83 and Hanhela, P J and Paul, D B, *Interactions Between F111 Fuselage Fuel Tank Sealant. Part 2. Variation in Performance Properties of Polysulphides After Contact with Polyester Degradation Products*, MRL Technical Report MRL-R-658; Aug 84.

[46] LAV.0018.011, Comments on F111 Fuel Tank Deseal/Reseal Procedures; 30 Jun 75.

[47] LAV.0018.033, Materials for F111C Fuel Tank Deseal/Reseal; 4 May 76.

[48] LAV.0018.083, Briefing to DEFAIR; 4 May 76.

[49] LAV.0016.053, F111C Fuel Tank Deseal/Reseal – Disposal of Waste Desealer and Rinse Solutions; 2 Dec 76.

[50] Phenyl disulphide (also known as diphenyl disulphide) is a solid at room temperature and insoluble in water. Its toxicological properties are not fully known (CAS No 882-33-7).

[51] AMB.0083.006, Hanhela, P J and Paul, D B, *Evaluation of Treatment and Disposal Procedures for Waste Desealant Solutions from the F111C Deseal-Reseal Programme*, MRL Technical Report MRL-R-655; Feb 79.

[52] LAV.0016.053, F111C Fuel Tank Deseal/Reseal – Disposal of Waste Desealer and Rinse Solutions; 2 Dec 76.

[53] LAV.0027.008, Minutes of the F111C Deseal/Reseal Conference at No 3 Aircraft Depot; 28 Apr 77.

[54] LAV.0027.262, Correspondence concerning Deseal/Reseal Facility - RAAF Base Amberley from the Office of Environment Protection; 6 May 77.

3.45. AIRENG1D recommended an incinerator manufactured by Major Furnaces that was versatile enough to dispose of the waste, which included 'Tek blocks' that were proposed for soaking the hydrocarbons from the top of the separator dam, and complied with EPA standards[55].

3.46. When Desealing began in 1978, the used SR51 was placed in a 1,000 gallon container awaiting finalisation of the disposal procedures[56].

3.47. The MRL Technical report on waste sealants was produced in February 1979[57]. A Base safety meeting raised the issue of SR51 storage and a Hazard Report was to be produced as a result[58]. MRL representatives then attended a discussion at 3AD in March. Base Squadron officers were concerned about the reliability and performance (design throughput was not attained) of the incinerator, and also where the responsibility for it lay. DOC was reluctant to become involved because of the presumed hazards involved with SR51[59].

3.48. An MRL representative suggested that burning was the only viable option and defined responsibilities for Amberley staff[60]. To alleviate concerns[61], MRL produced an Assessment of the Health Risks Involved in the Handling of Waste SR51, advising the avoidance of high vapour concentrations and skin contact and the use of 'washrack' clothing and gloves when handling waste materials[62]. Medical Officers also added their opinion, but could not provide a measure of thiophenol content to check against TLV's[63].

3.49. In March 1978 the incinerator was inspected and it was found not to be functioning correctly due to the practice of incinerating all SR51 waste products, including the polysulphide sludge. The process of removing the sludge from the SR51 solution was not being followed[64]. The 44 gallon drums of waste SR51 were to be inspected every fortnight[65]. These drums were found on occasions to be leaking[66]. Ultimately, when MRL staff visited Amberley in December 1980, the disposal furnace was working satisfactorily with no backlog[67].

3.50. At the end of the DR program the RAAF had an excess of Eldorado products in Australia[68] and at SM-ALC[69]. SM-ALC purchased some of these excess products[70]. The amounts are shown below in Table 6.8. The reason for the excess in materials is that orders were placed in anticipation of the whole program being completed in Australia. But a decision was made to complete the Deseal/Reseal at SM-ALC, leaving excess with no foreseeable use[71].

Table 3.5: RAAF Holdings of Eldorado Chemicals after the first DR Program

Chemical	Amberley Holdings as at Feb 82 (gallons)[72]	SM-ALC Holdings as at Feb 82 (gallons)[73]	Amberley Holdings as at Oct 83 (gallons)[74]
SR51	4 565	1 155	4 455
SR51A	4 070	495	4 180
ED500	1 100	522.5	unknown

55 LAV.0027.225, Supply of Incinerator for Amberley; 22 Jul 77.
56 LAV.0004.166, Visit to RAAF Base Amberley; 13 Feb 78.
57 AMB.0083.006, Hanhela, P J and Paul, D B, *Evaluation of Treatment and Disposal Procedures for Waste Desealant Solutions from the F111C Deseal-Reseal Programme*, MRL Technical Report MRL-R-655; Feb 79.
58 AMB.0077.061, Minutes of the Base Ground Safety Committee Meeting Held at Amberley; 19 Mar 79 at par 21.
59 LAV.0016.206, Discussion of SR51 Toxicity, Storage and Disposal held at 3 AD; 8 Mar 79.
60 LAV.0001.099, Visit to RAAF Base Amberley; 9 Mar 79.
61 MRL.0001.119, 3AD/2506/69/SR51 - Toxicity - Storage/Disposal; 25 Mar 79.
62 MRL.0004.264, Assessment of Health Risk Involved in Handling of Waste SR51; 26 Mar 79.
63 AMB.0071.043, Toxicity of Thiophenol in Deseal of F111 Fuel Tanks; 4 Apr 79 and AMB.0071.039, SR51 Toxicity, Storage and Disposal; 4 Apr 79.
64 AMB.0071.038, Disposal of SR51; 20 Mar 79.
65 AMB.0055.001, Storage of SR51 for Deseal/Reseal; 20 Aug 79.
66 AMB.0082.001, Hazard Report - Hangar 279 – RAAF Base Amberley; 30 Jan 79 and AMB.0055.005, Storage of SR51 for Deseal/Reseal; 24 Oct 80.
67 LAV.0033.037, Report of Visit to RAAF Base Amberley; 10 Dec 80 at par 6.
68 LAV.0024.166, Desealant Issue; 22 May 82.
69 LAV.0012.079, RAAF Desealant Assets; 17 Feb 82.
70 LAV.0024.164, Q822/SLO, Operation Cold Seal Program at McClellan AFB; 12 May 82.
71 LAV.0024.159, QTND BSAMB 111/83; 21 Sep 83.
72 LAV.0024.166, Desealant Issue; 22 May 82.
73 LAV.0012.079, RAAF Desealant Assets; 17 Feb 82.
74 LAV.0004.222, Disposal Information; 26 Oct 83.

3.51. Equipment officers in HQSC considered SR51 to have a high monetary value and considered disposal by destruction as a last resort, preferring to return holdings or re-sell it[75]. After information from MRL, it was decided to transfer any useable desealant to new containers[76], and to then destroy old contaminated containers[77].

3.52. In 1986 there were 167 barrels of SR51 and SR51A stored near the 'rag hangar'[78]. SM-ALC was asked if they wanted the material[79], but declined[80]. HQSC re-investigated disposal while 3AD queried the possibility of deodorising the drums to alleviate the smell problem[81]. There were also concerns with contamination of the storage compound and the original overflow dam[82].

3.53. HQSC AIRENG4 accepted responsibility for coordinating final disposal[83]. Two options were considered; incineration at Amberley (with emission-control modifications), or overseas contract disposal via AACI[84]. MRL offered advice as to the deodorising of the drums and the contaminated areas[85]. There was concern regarding the use of a contractor for disposal[86].

3.54. By August 1987, CO 3AD was concerned with the lack of progress and requested action to be taken by HQSC[87]. In early 1988, AIRENG4 investigated the offshore incineration option[88] and in April that year, AACI quoted a price for removal which could be initiated as early as May[89]. A strong case for this method was put to senior logistics officers in Support Command[90].

3.55. In November 1988, waste SR51 was finally removed from Amberley, almost seven years after the last aircraft was desealed in Australia. Supply Support Squadron, Amberley reports that AACI took full responsibility to re-drum the SR51, remove contaminated soil and other materials, and to store them in Sydney pending a disposal contract[91].

3.56. **One final note on disposal.** Some evidence was presented to the Board that an amount of SR51 was burnt regularly during fire training for FIREFTRs[92]. This apparently continued up until about 1990. Frequency was a couple of times a week in the late 1970s. By the late 1980's the frequency had declined.

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75 AMB.0020.013, SADMINSO 1804/14/3/MED(3); 9 Nov 83.
76 LAV.0009.056, Deseal Compounds – RAAF Base Amberley; 10 Jan 1984.
77 AMB.0075.006, Disposal of Empty SR51 Containers; 20 Aug 84.
78 LAV.0024.191, TN 3AD 273/CO 3AD, Disposal of SR51; 16 Jan 86.
79 AMB.0083.152, AIR1/4080/A08/329, Disposal of Chemical Desealing Agents - SR51 and SR51A; 27 Jan 96.
80 LAV.0024.186, Disposal of Chemical Desealing Agent SR51; 13 Feb 86.
81 Deodorising is the breaking down of mercaptan content with sodium hypochlorite.
82 LAV.0024.157, Deodorising SR51 Chemical Desealing Agent; 17 Mar 86.
83 LAV.0024.151, AIR4/0107-08/Pt 1 (36), Disposal of Desealing Agent SR51; 15 Apr 86.
84 LAV.0024.133, Disposal of SR51; 30 Apr 86.
85 LAV.0024.132, Conversation Record – Deodorising SR51; 1 Jul 86.
86 MRL.0001.084, Disposal of Excess SR51 Desealant; 13 Aug 86.
87 CBR.0022.122, Disposal of SR51 Desealant; 3 Nov 87.
88 CBR.0022.126, Conversation Record – Disposal of SR51; 15 Apr 88 and LAV.0006.237; 15 Apr 88 at par 1502.
89 AMB.0083.097, Chemical Waste Disposal Agreement; 1 Apr 88 and AMB.0083.103, Disposal of Toxic Wastes; 18 Apr 88.
90 AMB.0083.106, Disposal of SR51 Desealant; 19 May 88.
91 CBR.0024.147, Disposal of SR51 Desealant; 13 Nov 88.
92 MAN.0120.001, Witness Statement of Daniel Edward Petty at pages 2-4 pars 11-24.

CHAPTER 4 - THE SECOND DESEAL/RESEAL PROGRAM 1991 – 1993

EVENTS LEADING TO THE SECOND DESEAL/RESEAL PROGRAM

4.1 The F-111 aircraft continued to demonstrate a propensity for fuel leaks after the first DR program. This was due to the inability to remove all degraded polyester faying surface sealant, the normal life of the products in use, and some question over the appropriateness of all processes employed on the first program. The USAF experience showed that major degradation of sealant could be expected from about the seven-year mark of service life. The need for a second fuselage DR program was not therefore 'unexpected'[1]. A program for the wings had commenced at 3AD in August 1985.

4.2 In 1988, correspondence from 482SQN indicated that the extent of fuel leaks required the commencement of planning for another fleet-wide DR program. However, HQSC chose not to act until further evidence supported the need. By May 1989, six aircraft were unserviceable due to major fuel leaks, the repair of which was beyond the resources of 3AD. Commander Strike Reconnaissance Group consequently pressed for a fuselage DR program to be urgently budgeted, planned, and activated[2].

4.3 A number of options were examined for the conduct of the program, namely, at SM-ALC in the US, in Australia using 3AD or contractors, or a combination of these options[3]. The relevant factors were the need to conduct a two line program to meet the constraints of 'aircraft condition, annual fleet ROE, avionics update program and CPLT input requirements'[4], and the workforce shortages at Amberley[5]. On 28 January 1990, the decision was made to release a Request for Tender (RFT) to Australian industry for a fuselage DR program to be conducted at Amberley in RAAF facilities, commencing no later than 1 February 1991. This was in addition to a Letter of Agreement (LOA) that had been negotiated with SM-ALC to deseal/reseal a total of five RAAF aircraft. Although considered as an option, the completion of the Wings DR program already under way was not included in the RFT[6].

Cause of Sealant Failure

4.4 MRL conducted an investigation to determine the cause(s) of the sealant failures. The investigation revealed that the polysulphide fillet sealant and the underlying epoxy barrier coating could be manually peeled from the painted tank surface when prepared by the recommended methods and that two aspects were responsible for the poor adhesion. The first involved the application of the barrier coating over incompletely cured priming paint, resulting in solvent attack of the barrier. The second procedure, involving the use of so called 'titanate adhesion promoter', significantly reduced peel strength of the barrier coating to the paint. Changes to these two steps were adopted for the second DR Program[7].

Variations to the First Deseal/Reseal Process

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1 CBR.0019.268, HQ SRG 482S/2506/36 Tech Pt 4 (64); 22 May 89.

2 CBR.0019.268, HQ SRG 482S/2506/36 Tech Pt 4 (64); 22 May 89.

3 CBR.0020.311, 3AD/2506/68/Tech Pt 8, F111 Fuselage Deseal/Reseal at No 3 Aircraft Depot; 17 May 89.

4 LAV.0023.218, HQSCLOGORO Message of 140604Z; 14 Jul 89.

5 CBR.0019.268, HQ SRG 482S/2506/36 Tech Pt 4 (64); 22 May 89.

6 LAV.0019.007, Update F-111 Fleet Maintenance and Management Issues. This reference relies in part on a CAS decision in DEFAIR Material 130/DLPOL-AF to proceed with an RFT to Australian industry; 28 Jan 90.

7 MRL.0012.265, MRL-TR-93-64, Batten, Huang and Wake, Improved Resealing Procedures for the Second Deseal/Reseal Program in RAAF F-111 Aircraft Fuel Tanks; Jan 1994.

4.5 Two possible techniques for a second DR program were considered, namely, the removal of the old sealant with the aid of a chemical softening agent such as SR51 (as for the first program), or the removal of the old sealant by hydrolasers alone. 3AD, in a staff paper of 1 June 1989, recommended that a chemical softening agent not be used 'due to the significant health, environmental, and morale problems experienced with the use of SR51 on the previous D/R program'. 3AD further reported that:

> 'SM-ALC have ceased the use of softening agents on their deseal program for these reasons and have experienced minimal, if any, extension of the time taken to complete an aircraft's deseal. The additional time taken to remove old sealant by hydrolaser is more than offset by the reduction in time taken to apply the chemical softening agent and clean up the resultant residue.[8]'

4.6 This recommendation was put into affect. In a message to DEFAIR on 20 September 1989, HQSC Staff Officer Repair and Overhaul advised that: 'The Deseal/Reseal process to be used in the forthcoming program does not include the use of toxic chemical softening agents such as SR51 used in the last Deseal/Reseal. The only chemicals authorised are general cleaning solvents already in use in the Wing Deseal/Reseal Program. MRL are investigating an environmentally safe chemical softening agent, but as yet tests are inconclusive.[9]'

4.7 Of interest, for a fleeting period during 1990, the RAAF toyed with moving to the new generation polythioether sealants for the second DR based on preliminary advice from Products Research Company (see spray seal process at Chapter 6). However, while the procedure had reportedly been applied by Lockheed to the F-117 fleet with good results over the previous four years, due caution prevailed to ensure that proper process validation could be assured.

Standing Offer - Hawker De Havilland

4.8 In a press release on 13 October 1989 it was announced that tenders would be called for a fuselage Deseal/Reseal Program[10]. The RFT was ready for issue to industry at the end of 1989, however, could not be issued as funding for the program was not available. Funding approval and authorisation for the RFT to be issued was given by the Chief of Air Staff (CAS) on 28 January 1990[11]. The RFT was released to industry on 21 March 1990, with a tender closing date of 30 May 1990. Hawker De Havilland (Vic)[12] was contracted per Standing Offer PV8440[13] dated 21 December 1990[14].

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8 CBR.0020.311, 3 AD/2506/68/Tech Pt 8( ), F111 Fuselage Deseal/Reseal per 3AD; 17 May 89.
9 LAV.0022.171, Message to DEFAIRENG from HQSCLOGSORO; 20 Sep 89.
10 LAV.0025.184, News release from RO5, GPCAPT K J Cairns; 13 Oct 89.
11 LAV.0019.073, DEFAIR Material 130/DLPOL-AF; 28 Jan 90.
12 HdH personnel, including Michael Gleeson (HdH Facility Manager at Amberley) visited British Aerospace and SM-ALC regarding DSRS in early 1991. HDH.0002.122, HdH Internal Memorandum of 14 Feb91 prior to the finalisation of the tender.
13 AMB.0091.186, The Standing Offer; 04 Dec 90.
14 LAV.0026.190, F111 Deseal/Reseal Standing Offer; 21 Dec 90.

Terms of the Standing Offer[15]

4.9 The terms of the Standing Offer concerning Hawker de Havilland and the second DR program included the following:

a. 'The Contractor shall undertake the Deseal/Reseal of the F-111 fuselage integral fuel tanks as detailed in the Standing Offer [clause 3.1], with the technical requirements being listed at Annex B.
b. All maintenance activities associated with the Deseal/Reseal shall be carried out in accordance with the RAAF publications listed at Annex A [clause 3.2]. Such publications include; Aircraft Fuel Tank Maintenance Hazard Control Instructions; AAP 7214.003-292-1 (Deseal/Reseal Procedures); AAP.7214.003-292-2 (Deseal/Reseal Work Sheets); AAP 7214.003-292-3 (Deseal/Reseal Health, Environment, Quality Control).
c. The Contractor shall be required to operate/manage the Deseal/Reseal Program in RAAF facilities at RAAF Base Amberley [clause 3.8].
d. The Standing Offer shall be in force from 19 Oct 90 to 31 Oct 93 [clause 4.1].
e. The Contractor shall institute and maintain a Quality Control System [clause 7.1].
f. Clause 24.1 provided for an exemption from liability of the Commonwealth for personal injury, disease etc and Clause 24.2 provided for the Contractor indemnifying the Commonwealth in specified circumstances.

Evolving Deseal/Reseal Procedures

4.10 RAAF publications prescribed in the Standing Offer included: AAP 7214.003-292-1 detailing the DR procedures, AAP 7214.003-292-3 and 3AD Unit Maintenance Orders containing health, environment and quality control information, and Aircraft Fuel Tank Maintenance – Hazard Control Instructions (no publication reference number is available for this document). Several documents refer to this publication including the Standing Offer[16].

4.11 Hawker de Havilland had a series of its own publications, including:

a. A Product Assurance Manual (PAM 2).
b. Quality Procedure 101 (QP 101).
c. Contractor Maintenance Instructions (CMI's).
d. Quality System Documentation (QP 2).
e. Corrective Action Procedures (QP 79).
f. Inspection Performance Monitoring (QP 13).
g. Training (QP 29).

Changes in AAP 7214.003-292-1 Procedures from First to Second DR Programs

4.12 Amendment 3 to AAP 7214.003-292-1, dated September 1989, included the following amendments to procedures which were in place for the first DR program:

a. Broad warnings were included regarding the toxicity of chemicals and the need for PPE.
b. Warnings were included regarding the sensitivity of D6AC steel.
c. Chapter 7 was removed and Chapter 8 modified (this removed the chemical desealing step).
d. The need for a final wash of the tanks using a solution of 25% ED500 was removed and water was used instead.

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15 AMB.0091.186, Where tenders are invited, not for any definite number or quantity of supplies, but for such supplies or services as may be ordered during the relevant period, any contract let under these conditions is deemed to be a Standing Offer Contract Conditions, Standing Offer Acceptance, File No. 06/94604F-1; 04 Dec 90 at clause 1.1.

16 LAV.0023.191, AIR1/4080/A08/341/3 (17); 07 Aug 89 and AMB.0063.001, PMO 1814/1/19/MED Pt 1 (60).

e. The need to repair any damage to surfaces with MIL-C-27725 (823-707) corrosion protective coating (Chapter 3) was added.
f. The need to remove any flaking or blistering paint from the surface of the tank with MEK (containing toxic warning) was added.
g. The need to paint all areas where sealant is to be applied with MIL-C-27725 coating (823-707) (Chapter 9) was added.
h. A new version of XA 3598 epoxy was added, namely EC3580, together with a toxic warning for EC3580.
i. Toxic warnings were added for 'Mil-Spec', PR148, and MIL-S-83430.
j. The need to wipe all surfaces upon which MIL-S-83430 is to be applied with a cloth dampened with PR148 was added (this step was later removed).

4.13 Amendment 4 to AAP 7214.003-292-1, dated October 1990, included:

a. The need to seal the open holes of the wing, fin and fuselage with MIL-S-83430 B2 was added.
b. Warnings were added to Chapter 15 regarding kerosene.

4.14 Amendment 5 to AAP 7214.003-292-1, dated September 1991, included:

a. Most references to the use of PR 148 were removed, however, it was retained for use in the saddle tank panel reinstallation.
b. Reference to MEK was removed with 'Mil-Spec' only being used, however, the MEK toxic warning was retained.
c. The need to inject all accessible external and internal injection seams with PR1750 C6 sealant to eject polyester was added.
d. Toxic warnings for MIL-S-83430, 'Mil-Spec' and the epoxy barrier were added.

Changes to AAP 7214.003-292-3 - 5 December 1979 to 13 September 1990

4.15 AAP 7214.003-292-3 concerns the health, environment, and quality control for the DR process. Amendments between the two DR programs included:

a. Definitions of Warnings and Cautions were added.
b. The chapter on chemical desealing was deleted.
c. A new Chapter 1 titled 'Health and Environmental Protection: Aircraft Fuel Tanks – Hazard Control' was added which included:
  (1). Controlling hazards associated with fuel tank maintenance.
  (2). A warning that entry into and movement within many aircraft fuel tanks is restricted and difficult, that conventional rescue techniques may not be appropriate in the event of a mishap; therefore it was essential that precautions were taken to reduce all risks to a minimum.
  (3). A stated aim which was to identify the major OH&S hazards involved with fuel tank entry and to provide guidelines for the development of procedures for safe fuel tank entry.
  (4). Definitions for: Hazard, Risk, Lower Explosive Limit (LEL), Upper Explosive Limit (UEL), Flash Point, Threshold Limit Value (TLV), Confined Space, Responsible Person, Intrinsically Safe Combustible Gas Meters (Explosive Meter), Explosion Proof Equipment, Fire Safe, Health Safe.
  (5). Applicable Australian Standards for fuel tank maintenance; particularly AS 2865 'Safe Working in a Confined Space'.
  (6). Major hazards (and describes them) such as: Oxygen Deficiency; Toxicity; Direct Contact; and Explosion with discussion of the effect of temperature on these hazards.
  (7). Evaluation of hazards.
  (8). Application of sealants and solvents.
  (9). Selection of PPE and engineering support.
  (10). Supplied breathing air.

(11). Ventilation.
(12). Stand-by-person.
(13). Entry without Air Supply Respirator.
(14). Fuel Tank Entry Permits.
(15). Monitoring During Tank Occupancy.
(16). Rescue and First Aid.
(17). A warning that sealants and epoxies are moderately toxic to the skin etc was added.
(18). Adding a section on 'PR-148 Adhesion Promoting Agent' and 'Cleaning Solvent: for use in integral fuel tanks'.
(19). Removal of the requirement for health monitoring.

4.16 As an overview, the specific pre-employment checks and health monitoring required during the first program were not specified for the second program; this was left to the contractor to resolve with employees. From documents and witness statements health assessments were usually arranged by Hawker De Havilland, at the beginning and the end of employment on the program[17], and in the middle of the program[18]. Health monitoring, which included blood testing[19], was generally conducted by a Doctor James Tankey located at Wharf Street, Ipswich[20]. Staff had to be 'medically fit' and they had to complete a course on fuel tank entry addressing, amongst other things, chemical hazards and PPE, and this was to be refreshed at least annually. The greatest concern was with the potential hazard represented by working with the high pressure water gun in confined spaces. Whenever solvents or sealants were in use within tanks, air supplied respirators and 'other appropriate protective clothing' were mandated. At all times when a person was inside a tank, forced air ventilation was to be applied to ensure maintenance of a safe working environment. A system of fuel tank entry permits was instituted with comprehensive data requirements and with tank atmosphere required to be regularly monitored, the periods being variable depending on conditions. No time limits for working within confined spaces were specified.

Facilities

4.17 The work was to be conducted at Amberley in refurbished Bellman hangars, building numbers 278 and 280, that were 3AD/501WG controlled facilities.

4.18 The contractor was made responsible for the following facility requirements[21] per the Standing Offer[22]:

a. Drainage. A drainage system suitable for significant quantities of water. An in-floor waste separation and collection system required for solid waste separation.
b. Environmental Requirements. The Contractor must comply with all Commonwealth, State and Local Government Environmental rules.
c. Air Compressor. A suitable air compressor to provide a breathable air source and compressed air for tools. It should provide approx 2000 litres/min at 100 Psi since 1200 litres/min is required for the breathing air source alone. Breathing air from the compressor must comply with AS 1716-1982.
d. Hot Air Supply. Required for the drying of fuselage fuel tanks.
e. Ventilation. Adequate ventilation to prevent build-up of toxic and noxious fumes. Natural ventilation should be sufficient in the aircraft bays.
f. Fire Detection/Suppression. Must include smoke curtains, smoke vents, photo-optical smoke beams and infrared detectors.

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17 WIT.0011.001 (at 012) statements of Roger Paul Amiss; 11 Dec 00 at page 11, par 48. WIT.0025.001 (at 019) Statement of Hugh Charles Betteridge; 08 Dec 00 at page 18, pars 75-77.
18 WIT.0515.001 (at 014), Witness Statement of Barry Thomas McGrath (Manager Support Services) at page 14 par 42.
19 For example, see Minutes of HdH Meetings; 02 Nov 92, which refer to requirements for blood test.
20 WIT.0515.001 (at 014), Statement of Barry Thomas McGrath (Manager Support Services) at page 14 par 41.
21 MAN.0105.001 (at 006-008), Witness Statement of Michael Gleeson (Facility Manager) at page 6-8 pars 27-39 provides details of the actual HdH modifications/additions to facilities. He indicates HdH exceeded RAAF requirements in relation to certain facilities including the provision of breathable air.
22 AMB.0091.182, Standing Offer Contract Deseal/Reseal Facilities at RAAF Base Amberley- Annex E, cl 1.3; 4 Dec 90.

g. Power Services. Sufficient power services including flameproof 240V/15A/single phase/50Hz and 415V/36A/three phase/50Hz outlets.
h. Lighting. Suitable for shiftwork operations and must be flameproof. External lighting for security purposes.
i. Water supply. Supplied for domestic use and hydrolaser operations (14-16 litres/minute/each). Up to four hydrolasers may be in simultaneous operation.
j. Eye Washers. Must be provided in aircraft hangars.
k. First Aid Facilities. Must be provided in aircraft hangars.

4.19 The Standing Offer indicated that the contractor was also responsible for providing demountable-type buildings to satisfy office, workshop, and domestic requirements. The accommodation was to include:

a. Ablutions (toilets/showers/change rooms and decontamination (laundry) facilities.
b. Workshop areas including sealant-mixing area, refrigeration storage area, safety clothing and equipment store, structural fitters' workshop, and GSE storage/maintenance area.

4.20 The Contractor was also responsible for the construction of a toxic waste storage area for Deseal/Reseal wastes awaiting disposal by the Contractor.

Equipment

4.21 Table 4.1 lists equipment prescribed in the Standing Offer for the second DR program of relevance to this Inquiry.

Table 4.1: Equipment Prescribed by the RAAF during the 2nd Deseal/Reseal Program.

Equipment Required	Part Number
Work Platforms and Ladders	Unknown
Sealant Injection Gun	Not Identified
Sealant Mixer	Not Identified
Air Conditioner	4120-66-095-1526
Vacuum Cleaner	7910-00-632-9840
Line Purifier Regulator	4240-66-038-0081
Hydro Laser	4920-66-107-0105
Hydro Laser Lances and Tips	Not Identified
Deep Freezers	Not Identified
Steam Cleaner Unit	4940-66-057-9409
Refrigerator	4110-66-026-2213
Extrusion Gun	5130-00-891-3375

Additional Facilities Provided by Hawker de Havilland

4.22 In addition to the prescribed facilities, Hawker de Havilland put in place various facilities[23], including:

a. Two BAUER breathing air compressors providing breathable air for the workers in the hangars at Amberley and in the sealant hut. They were sourced from outside the hangar. In addition emergency breathing air bottles and an alarm system were added to the breathing air system.
b. Two large air conditioners were located outside each hangar providing a hot air supply for purging fuel tanks.
c. First aid facilities were upgraded.
d. A Venturi extraction fan was purchased to provide greater fume extraction.

[23] See MAN.0105.001 (at 006-008) Witness Statement of Michael Gleeson (Facility Manager) at pages 6-8, pars 27-39, WIT.0515.001 (at 002-003) Barry McGrath (Manager Support Services) at pages 2-3, par 7.

Aircraft in Program

4.23 Seventeen aircraft were processed through this second program by HDH between April 1991 and August 1993. Five aircraft were processed through SM-ALC between March 1990 and March 1994.

Table 4.1: F-111 Second Deseal/Reseal Program

Tail No.	Date In	Date Out	DR Loc
A8-112	Early Feb 90	Mid Oct 90	SM-ALC
A8-131	9 May 90	20 Nov 90	SM-ALC
A8-113	22 Aug 90	19 Jun 91	SM-ALC
A8-129	08 Oct 90	17 Jun 91	SM-ALC
A8-129	08 Oct 90	17 Jun 91	SM-ALC
A8-126	08 Apr 91	30 Sep 91	3AD
A8-127	21 Jun 91	28 Nov 91	3AD
A8-135	15 Aug 91	22 Jan 92	3AD
A8-130	14 Oct 91	28 Feb 92	3AD
A8-114	29 Nov 91	24 Apr 92	3AD
A8-125	31 Jan 92	16 Jun 92	3AD
A8-138	16 Mar 92	04 Aug 92	3AD
A8-147	06 May 92	11 Sep 92	3AD
A8-145	16 Jun 92	30 Sep 92	3AD
A8-146	27 Jul 92	23 Nov 92	3AD
A8-140	02 Sep 92	11 Jan 93	3AD
A8-134	02 Nov 92	26 Feb 93	3AD
A8-109	23 Nov 92	29 Mar 93	3AD
A8-142	11 Jan 93	19 May 93	3AD
A8-143	26 Feb 93	21 Jun 93	3AD
A8-148	29 Mar 93	22 Jul 93	3AD
A8-144	24 May 93	27 Aug 93	3AD

The Second Deseal/Reseal Process

4.24 The process for the second program was similar to the first, with the major exception that the chemical desealing phase was dropped. The work was recorded as F-111 Special Servicing 37 (S37) and the broad process was as described in Chapter 3 for the first DR program, but missing steps d through k, and steps m and n. Additionally, application of the PR148 adhesion promoter at steps u and v was discontinued from the end of 1991 on the basis it was suboptimal.

4.25 The statement of the Hawker de Havilland Facility Manager indicates that Hawker de Havilland staff followed the prescribed process during the second DR program save for the following[24].

a. Purging air was used throughout the DR process.[25] This was designed to eliminate fumes in the fuel tanks, reduce the LEL readings to acceptable levels prior to fuel tank entry, provide for worker comfort while in the fuel tanks, provide a stable internal temperature, and to dry the tanks after the completion of the water picking. Two reverse cycle air conditioning units supplied the purging air with a dehumidifying system located outside each hangar.

b. After the epoxy barrier had been applied, four separate layers of sealant were applied with an inspection after each layer.

c. As noted earlier, P148 adhesion promoter was only used on the first two aircraft. The step was removed at Hawker de Havilland's request and with RAAF approval.

d. There was no finger tank isolation. Finger tanks were inspected for serviceability only.

e. After the sealant application and inspection processes were completed the tanks were re-plumbed, final inspections carried out and the fuel tank entry panels replaced. Once

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24 MAN.0105.001 (at 008-011) Witness Statement of Michael Gleeson (Facility Manager) at page 8-11, pars 41-51.

25 See WIT.0514.001 (at 003), Witness Statement of Keith Barnard (Shift Supervisor) at page 3, par 12 (a).

the tank covers were replaced the testing process began which included re-fuelling the aircraft, pressure testing, operation of all the fuel systems, defuelling and refuelling several times to ensure the cleanliness of the fuel system and that it was clear of any foreign objects. A final pressure check of 6-8 hours was conducted to ensure a leak free product was delivered. This final check was viewed and signed off by the RAAF DQA representative.

Conduct of the Second Program.

4.26 Hawker de Havilland had contracted to undertake the Deseal/Reseal of F111 fuselage integral tanks, including aircraft preparation, fuselage disassembly, deseal/reseal of the integral fuel tanks and aircraft restoration[26]. The RAAF involvement in the conduct of the program was limited to overseeing the contract, which included quality control and liaison, and conducting technical repair work but not deseal/reseal tasks.[27] An office of (RAAF) Resident Engineer (RESENG) was established as well as an on-site Defence Quality Assurance (DQA) officer being appointed. The RESENG office was to be the on-base point of contact for all liaisons with the contractor. The role of DQA was to audit and oversee the company quality system and plan on a regular basis[28].

4.27 The Minutes of the Deseal/Reseal meeting, held at HQSC on 27 June 1989, reported that the:

> ‘success of the DSRS program would depend on adequate supervision and the quality of the workmanship. The task is tedious and does not necessarily require the skilled aircraft tradesmen, however, training will be critical for both safety and engineering reasons.[29]‘

4.28 The second DR program contained positive elements of a management nature. These included the training and quality control frameworks that were required by the Standing Offer. Additionally, Hawker de Havilland at a management level created extensive quality control, OH&S and training structures, either pursuant to, or in addition to, the conditions contained in the Standing Offer.

4.29 Hawker de Havilland received a number of awards during the second DR program which included:

a. Employer of the Year - Aviation. Queensland Training Awards ‘in recognition of training excellence.’ Queensland Minister for Employment, Training and Industrial Relations. 5 October 1992[30].
b. Australian Industry Quality and Achievement Award 1992. Winner Category - Supply and Services ‘for F111 Aircraft Fuselage Fuel Tank Deseal/Reseal program for the Royal Australian Air Force.’ Awarded by the Minister for Defence[31].

TRAINING

Training Requirement of the Standing Offer

4.30. As required in the Standing Offer, contractor personnel were to complete a 3AD Deseal/Reseal Training Course at RAAF Base Amberley. The course duration was to be five working days, and was compulsory for all contractor tradesmen and trade supervisors[32]. The RAAF obligation was to ensure that a minimum number of contractor staff was given formal training before the

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26 AMB.0091.186, Standing Offer Contract Deseal/Reseal Facilities at RAAF Base Amberley; clauses 3.1 and 3.2.
27 MAN.0105.001 (at 005-006, 022-023), Witness Statement of Michael Gleeson (Facility Manager) at pages 5-6, par 25 and pages 22-23, pars 106-109.
28 HDH.0013.032 (at 033), Minutes of an F111 DRRS Contract Meeting Held at Amberley on 12 February 1991.
29 CBR.0017.275 (at 280), HQSC AIE1/4080/A080/341 Part 3 (a) enclosure 1 at par 24; 21 Jul 89.
30 HDH.0002.336, Award Certificate. For details of the HdH submission regarding this award see HDHV Amberley Deseal Reseal Submission 1991-1992.
31 HDH.0002.335, Award Certificate For details of the HdH submission regarding this award see HDH.0009.038, 1991-92 Australian Industry Quality & Achievement Awards Nomination Hawker de Havilland Victoria Pty Ltd Deseal/Reseal Facility RAAF Base Amberley.
32 HDH.0009.090, Contract Conditions, Annex B-9; 01 Jan 91.

commencement of the program. The Standing Offer provided that formal training of contractor personnel would then be conducted on an opportunity basis, and would be dependent on RAAF training commitments. The RAAF was then to offer on-the-job training (OJT) until completion of the first fuselage. After this, the Contractor was responsible for providing its own OJT for staff[33].

4.31. The five-day course reportedly covered four discrete areas, namely: aircraft safety aspects; the DR process itself; OH&S aspects of the program; and use of the hydrolaser[34]. Hawker de Havilland documents indicate seven DSRS Operators courses were conducted in 1991[35].

Hawker de Havilland Training Requirements

4.32. The Hawker de Havilland requirements for training are addressed in the Contractor Maintenance Instructions:

a. CMI 3.1 provides that the Manager Support Services was the Training Co-ordinator and specified that, among other courses, an F111 Deseal/Reseal Operators Course was to be conducted.
b. CMI 3.1 provided that on-the-job training was to be conducted by the Quality Controllers or qualified tradesman/specialists in the areas of safety and industrial and personal hygiene[36].
c. CMI 7.4 provided for Fuel Tank Maintenance Entry Safety Procedures and directed that training requirements be applied as contained in DI (AF) AAP 7214.003-292-3[37].

4.33. After February 1992, documentation regarding a DSRS operators' course is extensive[38]. The course content was described as including:

> ' … the Deseal/Reseal process, the materials that would be used during the process and all safety aspects including the handling of chemicals, the required Personnel Protective Equipment and general safety around the aircraft.[39]'

4.34. In addition to DSRS operators courses the Hawker de Havilland training structure included the following training:

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33 AMB.0091.171 (at 172), Contract Conditions, Annex B-10.
34 WIT.0515.001 (at 004, 005), Witness Statement of Barry Thomas McGrath (Manager Support Services) at pages 4-5, pars 10-12.
35 HDH.0009.062, DSRS Operators Course. It is a list of courses and attendees.
36 HDH.0016.027 (at 049), Contractor Maintenance Instructions - Distribution List; 2 Jun 92.
37 HDH.0016.027 (at 093), Contractor Maintenance Instructions - Distribution List; 2 Jun 92.
38 See for example, WIT.0025.001, (at 001-004) Statement of Hugh Charles Betteridge; 08 Dec 00 at pages 1-4, pars 2-10 Also: HDH.0014.012, HdH Internal Memo; 17 Feb 92.
39 WIT.0025.001 (at 010), Statement of Hugh Charles Betteridge; 08 Dec 00 at page 9, par 32.

a. Continuation and on the job training. OJT was required by CMI 7.4 as described above. Examples included: a staff briefing by an MRL representative concerning chemicals[40]; staff training concerning PPE from suppliers including Protector Safety Pty Ltd and Norton[41]; and briefings regarding chemicals and PPE at communications meetings[42]. Documents indicate an attempt to formally record continuation training and OJT on personal files[43].

b. OH&S-Related Specialist Training. Personnel responsible for OH&S attended external training courses including the Workplace Health and Safety Officer Courses at TAFE[44]. It is reported that these courses included Commonwealth OH&S legislation, safety inspections, and MSDS knowledge[45].

Hazardous Substance Training

4.35. Many of the chemicals used in the 2nd Deseal/Reseal process contain hazardous substances. A key component of hazardous substance training understands information about the chemicals. This is primarily achieved through personnel understanding the components and implications of the Material Safety Data Sheets that must, under Australian Standards, accompany the delivery of each chemical. If a person has an understanding of the hazards listed in the MSDS they should be able to apply the necessary safety precautions.

4.36. Training Conducted. As noted above, continuation and OJT training was either conducted on an as required basis or through the regular staff meetings which addressed chemicals amongst other issues. Also, there was some formal hazardous substance training for personnel employed on the 2nd Deseal/Reseal Program. The syllabus for the course developed by Hugh Betteridge did include instruction on chemicals in the Deseal/Reseal process. The syllabus included the following:

> ' … solvent cleaner MIL-C-38736 (MEK), it's properties and use, precautions during use and PPE during use; Alodine, it's properties and use, precautions during use and PPE during use; and, ‘know the types of sealants and barrier use during the F-111 Deseal/Reseal programme.[46]'

4.37. It is noted that the syllabus for the operator’s familiarisation course did not specifically refer to MSDS's as a topic. Regarding the dissemination of the content of MSDS's, CMI 9.1 provides for a toxic substances register (TSR) containing hazardous analysis data. The purpose of the TSR was to ensure personnel were aware of the hazard and the required PPE. The Quality Control Section was responsible for the maintenance of the TSR and that a provision was to be included for all personnel to initial that they had seen the hazardous analysis data when incorporated in the TSR[47]. Statements indicate that MSDS's were kept in the TSR and were available in a number of office locations[48].

4.38. Witness statements generally indicate there was some form of chemical awareness training conducted, either formal or informal, with MSDS's being generally accessible[49]. One witness statement indicated MSDS's were not provided[50], but this goes against the weight of evidence.

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40 WIT.0516.001 (at 011), Witness Statement of Maurice Saywell (Sealant Controller) at par 24.
41 WIT.0516.001 (at 011-012), Witness Statement of Maurice Saywell (Sealant Controller) at par 25
42 WIT.0515.001 (at 008-009), Witness Statement of Barry Thomas McGrath at page 8-9. par 24.
43 HDH.0009.067, HdH Memo from Support Services Manager to DSRS Operations Manager; 13 Apr 92
HDH.0009.086, HdH Internal Memo form DSRS Quality Controller to Training Coordinator; 02 Oct 91.
44 HdH records indicated that WIT.0515.001, Barry McGrath (Manager Support Services) and Wayne Drover (DSRS Operations Manager) attended such courses. HdH Amberley Training Record 1991/92, ARH reference A10-118.
45 WIT.0515.001 (at 010), Witness Statement of Barry Thomas McGrath (Manager Support Services) at page 10, par 28.
46 WIT.0025.001 (at 026, 027), Witness Statement of Hugh Charles Betteridge (at page 5 & 6 of enclosure).
47 HDH.0016.027 (at 138), CMI 9.1 at pars 7-8.
48 WIT.0516.001 (at 011 & 018), Statement of Maurice Saywell (Sealant Controller) at pars 23 and 34. Also WIT.0515.001 (at 005), Witness Statement of Barry Thomas McGrath (Manager Support Services) at page 5, par 14.
49 WIT.0011.001 (at 005 & 011), Statement of Roger Paul Amiss; 11 Dec 00 at page 5 & 9, pars 9 and 40. WIT.0012.001 (at 003), Statement of Ricky James Barrett; 11 Dec 00 at page 2, par 9. WIT.0025.001 (at 010), Statement of Hugh Charles Betteridge; 08 Dec 00 at page 9, par 32. WIT.0070.001 (at 009), Statement of John Nicholas Collinson; 06 Dec 00 at page 8, par 39.
50 WIT.0013.001 (at 009), Statement of Michael Rowan Boggan; 21 Dec 00 at page 8, par 31

2nd Deseal/Reseal Process Training

4.39. Training Received. As detailed above, a DS/RS operator's course was conducted that included the Deseal/Reseal process. Documents indicate that a significant number of these courses were conducted[51,52]. Apart from formal courses, there appears to have been informal on-the-job training conducted during the 2nd Deseal/Reseal Program[53].

4.40. One witness did report that Hawker de Havilland did not provide him with any training[54]. However, given the weight of evidence regarding the Hawker de Havilland training structure, it is considered that this statement reflects the fact that this particular witness, as a former RAAF technician, came to Hawker de Havilland substantially trained. This is therefore not considered to indicate training structure.

Confined Space Entry Training

4.41. Hazards associated with work in confined spaces could cause fatal or debilitating accidents. Typical of such hazards that may have been encountered during Deseal/Reseal operations were:

a. release of harmful gases or liquids into the confined space;
b. high ambient temperatures;
c. exposure to asphyxiating, toxic, corrosive, or flammable substances; and
d. insufficient oxygen to maintain life[55].

4.42. AAP 7214.003-292-3 specifies that the safety precautions and hazards are checked and recorded on an entry permit, before entry is permitted. The 292-3 also states that the entry permit will contain the following information:

a. ‘location and description of the work to be carried out;
b. hazards that may be encountered;
c. worksite and fuel tank preparation;
d. atmospheric test results (LELs);
e. duration of validity, taking into account the likelihood of the temperature rising;
f. identification of the stand-by-person; personal protective equipment and clothing required;
g. chemicals permitted in the fuel tank; and
h. safety precautions required[56].

4.43. **Hawker de Havilland Training Requirements.** CMI 7.4 provided that training concerning fuel tank entry was to be in accordance with AAP 7214.003-292-3 and provided for a system of fuel tank entry certification.[57] There is documentary and witness evidence indicating that confined space entry was included on the induction course[58].

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51 See for example: HDH.0009.062, HDH document dated 4/8/92 (ARH reference A10-118) listing personnel who had attended courses including DSRS Operators courses.
52 AMB.0024.091, Deseal/Reseal Course List; 18 Jan 91.
53 See for example: WIT.0012.001 (at 003), Statement of Ricky James Barrett, 11 Dec 00 at page 2, par 9.
54 WIT.0416.001 (at 004-005), Witness statement of William Andrews at page 3-4, par 19.
55 OHSMAN1 Chapter 20 at par 2001.
56 PUB.0004.001, AAP 7214.003-292-3 Deseal/Reseal of F111C Fuselage Fuel Tanks Health and Environment Quality Control and Equipment Operating Instructions; 13 Sep 90.
57 HDH.0016.027 (at 093), CMI 7.4 at pars 7-10.
58 WIT.0515.001 (at 005) Witness Statement of Barry Thomas McGrath (Manager Support Services) at page 5, par 14. See also the syllabus which addresses fuel tank entry certificate enclosed with the WIT.0025.001 Witness Statement of Hugh Charles Betteridge and the Course Content document enclosed with the Completion Certificate for the HdH DSRS Operators Course which includes provision for ‘Entry Into Tanks’ Annex B to Manager Support Services Minute; 06 Apr 92.

CHAPTER 5 - THE SPRAY SEAL PROGRAM 1996 – 1999

DEVELOPMENT OF A SPRAY SEALING OPTION

5.1. Fuselage fuel tank leaks continued to plague the F-111. In 1990 however, the RAAF had become aware of a new method of repairing integral fuel tanks[1]. The method involved the spray application of a new and improved sealant over old sealant. Products Research Company had advised of polythioether sealants which had been applied by Lockheed to the USAF F-117 fleet with good results over the previous four years, and with very significant time-savings for aircraft repair. Lockheed claimed to have resealed all F-117 aircraft using PR-2911 with negligible leaks over the ensuing four years. However, the prohibitive cost of the Lockheed proprietary information meant that SM-ALC had developed their own procedures using the PR-2911 spray sealant on F-111 aircraft.

5.2. TLO SM-ALC recommended that the USAF not adopt the spray seal process at that stage as it was still largely unproven with respect to the F-111. He suggested that a small amount of PR-2911 be acquired for testing by MRL[2]. USAF tests had shown that PR-2911, when compared with PR1750, exhibited twice the tensile and peel strengths, three times the elongation rate and was not susceptible to breakdown on contact with the reverting polyester sealant. MMS425, an epoxy-based primer manufactured by DeSoto Chemicals, was used as the primer. Time-savings were significant. The MRL test results were similar[3].

5.3. Armstrong Report. Three separate surveys had been conducted at McClellan AFB by the Armstrong Laboratory during spray sealing operations. The purpose was to conduct a thorough industrial hygiene evaluation of this new fuel tank sealing process so the process could be safely applied. The Armstrong Report provided a brief description of the spray seal process, detailing the potential hazards, sealant materials and chemistry, the required PPE and facilities, and concluded the process could be done safely and efficiently[4].

5.4. RAAF Spray Seal Trial. In August 1992, DAFMED approved a trial conditional upon there being:

a. 'no deviation from the procedures laid down in the Armstrong Health Laboratory Report ... the severity of the potential hazards of the process are fully understood by personnel managing the process … an occupational hygienist be contracted to assess the process set-up particularly the efficiency of the ventilation, the adequacy of PPE chemical concentrations in the work area and potential fire safety and pollution hazards … and air sampling using the methodology described in the Armstrong Report … [5]'

5.5. An extended period then elapsed before the trial proceeded in March 1996 as a joint project between 501WG Fuel Tank Repair Section (FTRS) and SRLMSQN[6]. The effect of this lag was that the trial at 501WG became more a demonstration of the process by US staff and formal supervision of the trial was left to the lowest levels. Two SM-ALC technicians instructed on the work and provided supplementary equipment, including some GSE and PPE used by the USAF in their spray seal program. The trial was carried out in the 501WG Paint

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1 AMB.0087.191, F111 Sprayable Fuel Tank Sealant Procedures and Prototype Report. Air1/4080/A8/332 Pt 2 (42); 22 Feb 91.
2 AMB.0013.040, Development of Revised Sealant and Procedure for F111 Fuel Tank Reseal; 09 Jan 90.
3 LAV.0032.040, Minute Paper 'Trial Application of Sealable Integral Fuel Tank Sealant PR-2911'. Air1/4380/A8/332 Pt 3 (15); 18 Nov 91.
4 AMB.0020.082, Armstrong Laboratory, Industrial Hygiene Evaluation of F111 Fuel Tank Sealant Process (the Armstrong Report); 1 Dec 1992 at page 1.
5 AMB.0020.078, SM-ALC F111 Sprayable Fuel Tank Sealant, AF 91/6673 Pt (64); 6 Aug 92.
6 AMB.0010.022, Sprayable Sealant Trail Report, 501WG 1/4/4 AIR PT 4 (31); 13 Aug 96.

Shop and was conducted on the F1 and A2 tanks on Aircraft A8-147. A Special Technical Instruction (STI) was subsequently issued on 8 August 1996, retrospectively authorising the trial[7].

5.6. The monitoring program for the trial was conducted (by SIMTARS) of sites external to the fuel tanks. Consequently, exposure levels for the spray sealing process itself were not measured[8]. Air sampling reflecting that described in the Armstrong Report was not therefore conducted in line with the DAFMED direction. The scope of the air monitoring survey was very limited. SIMTARS was not required to analyse the adequacy of the supply and exhaust ventilation employed. As well, the air sampling that was done was limited to MEK and isocyanates. This is probably a reflection of the nature of chemical hazards expected to occur externally to the aircraft and the primer mixing area. SIMTARS cautioned that ‘there may be a risk of exposure to strontium chromate for personnel directly outside the fuel tanks during primer application”. This concern does not appear to have been pursued.[9]'

5.7. Spray Seal Trial Report. NCOI/C FTRS produced a report on the spray seal trial indicating that[10]:

a. ‘The SM-ALC technicians detailed all the safety aspects and hazards involved. Explanation on the minimum requirements in PPE was the main issue due to the high toxicity levels whilst spraying.[11]'

5.8. The report describes the trial as a 'complete success' and highlighted that one of the main advantages was to 'extend the life and reduce the maintenance hours on fuel tank repairs'[12]. The report also included some recommendations to modify Hangar 277 to enable a future Spray Sealing Program to be conducted in that facility[13].

5.9. Spray Seal Process Approval. Chief Engineer SRLMSQN appropriately approved the Design Approval/Acceptance Record (DAR) on 22 January 1997[14]. The procedure was authorised as INAM No 82 to AAP 7214.003-3B1-B5 Repair and Overhaul Instructions F111C Aircraft. Ultimately, the process was promulgated as AAP 7214.003-292-5. However, DAFMED was neither informed of the results nor asked for clearance of the procedure – nor was such approval formally required.

The Spray Seal Process

5.10. The general process outline was:

a. assess fuel tanks to be resealed;
b. defuel and purge all fuel tanks;
c. deplumb and remove fuel system components from the tanks to be sprayed;
d. reposition the aircraft to the 501WG paint shop;
e. alkaline wash the tanks using spray ZI400 in proportion to water of 1:10;
f. vacuum tanks and scrub surfaces with a soft brush;
g. rinse tanks with hot water and dry;

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7 AMB.0010.005, Sprayable Seal and Trial, Camm Key: STI-F111-684, 501WG 4080/A8/341 Pt 1 (18); 08 Aug 96.

8 IOI.0052.212, SIMTARS Occupational Hygiene, Environmental and Chemistry Centre, Laboratory Test Report for F111 Fuel Tank Sealant Monitoring conducted on 11 Mar 96, Report; 21 May 96.

9 HRG.0001.001 (at 038), Witness Statement of Richard James Sargeant Annex B at par 20-22.

10 AMB.0010.022, Sprayable Sealant Trail Report, 501WG 1/4/4 AIR PT 4 (31); 13 Aug 96.

11 AMB.0010.023 (at 025), Sprayable Sealant Trials Report Annex A to 1/4/4 AIR PT 4 (31); 30 Jul 96 at par 17.

12 AMB.0010.023 (at 026), Sprayable Sealant Trials Report Annex A to 1/4/4 AIR PT 4 (31); 30 Jul 96 at pars 32-33.

13 AMB.0010.023 (at 027), Sprayable Sealant Trials Report Annex A to 1/4/4 AIR PT 4 (31); 30 Jul 96 at par 38 and AMB.0010.034, Proposed Facility Adjustment to Hangar 277 - Enclosure 4 to Sprayable Sealant Report; 30 Jul 96.

14 AMB.0010.082, SRLMSQM Design Approval/Acceptance Record (DAR) - Procedure For the Application of Sprayable Sealant for the F111 Fuselage Integral Fuel Tanks; 05 Nov 96.

h. fill voids, gaps or crevices using EC3580 epoxy barrier as required;
i. apply alodine to any bare metal (the spray seal primer and sealant [polyurethane base] perform the function of the fuel tank paint);
j. ventilate tanks using two exhaust ventilation hoses and two supply ventilation hoses (flow rates specified);
k. wipe all surfaces with MIL-C-38736 solvent or MEK;
l. while continuously measuring the percentage of LEL so that a 10% level is not exceeded, spray Desoto MMS 425 primer onto all existing PR 1750 polysulphide sealant;
m. spray a layer of PR 2911A (white) sealant to all surfaces covered by the primer;
n. allow to partially cure and spray a second layer of PR 2911B (black) sealant;
o. leak test the spray sealed tanks and repair as required using PR 1826 B2 quick repair sealant;
p. refit components and plumbing;
q. conduct a fuel tank and system flush and return the aircraft to service.

5.11. No time limits for working within the tanks was applied. By comparison, the USAF spray seal program had limits of two hours for working in tanks and no more than four hours per eight hour shift inside the tanks.

The Spray Seal Program

5.12. The first spray seal subsequent to the trial occurred in March 1997. Table 5.1 lists those aircraft, by tail number, that have undergone spray sealing at 501WG:

Table 5.1: Aircraft Tail Numbers – Spray Seal Process

Aircraft Tail Number	When Sprayed	Comments
A8-147	Mar 96	Trial Aircraft F1 & A1
A8-129	Mar 97	F1 & F2
A8-514	Jun 97	A1
A8-277	Mar 98	All tanks
A8-129	Mar 98	Repair (Tank no. not listed)
A8-148	May 98	All tanks
A8-142	Oct 98	All tanks
A8-148	Oct 98	F2 Repair
A8-131	Oct 98	F1 & F2
A8-272	Nov 98	F2 Repair
A8-131	Nov 98	F2 Repair
A8-272	Feb 99	F2 Repair
A8-274	Feb 99	All tanks
A8-143	Mar 99	All tanks
A8-272	Mar 99	F2 Repair
A8-131	Apr 99	A1 & A2
A8-512	Jun 99	All tanks
A8-129	Jun 99	A1 & A2
A8-126	Sep 99	F1, A1 & A2
A8-514	Sep 99	F1, F2 & A2
A8-109	Oct 99	All tanks
A8-126	Nov 99	F2

Note: A8-281 & A8-272 were Spray Sealed at the SM-ALC facility.

5.13. Initially, the time taken to complete the spray sealing of a single aircraft was four weeks. This time was then reduced to two weeks and then one week. The reduction in time was achieved by spraying the forward and aft tanks in parallel[15] and by having two teams instead of one. The primary motivation for the reductions in time was operational[16]. There is

15 IOI.0001.331, Investigating Officer interview of CPL McClymont, at question 33.
16 See, for example, IOI.0001.331, Investigating Officer interview of CPL McClymont. See also the

no evidence of any review to determine any health and safety implications of the changes in time. The primary considerations were the quantities and capacity of equipment and facilities'[17];

Equipment

5.14. Table 5.2 lists the equipment specified for the spray seal process and any associated technical specifications.

Table 5.2: Specified Spray Seal Equipment

Equipment Required	Part Number
Primer Spray Gun	Devilbiss EGA 502 and ½ quart pressure pot or equivalent
Sealant Air Assisted Airless Pump	Graco 226-963 10:1 Monark Cart System or Equivalent (NSN 4940-01-187-5709)
Proportional Air Assisted Airless Pump	Graco Proportioning Pumps, Fluid Tanks, Air and Fluid Lines, Cart Mounted or Equivalent
Sealant Gun	Graco 217-292 AA2000 Air Assisted Airless Gun or Equivalent
Sealant Gun Extensions	Graco 915-654 or 915-655 or 915-656 or Equivalent
Nozzles (tip orifice)	Graco 182-215 or Equivalent
Filter	Graco 205-264 or Equivalent
Pneumatic Drill Mixer	Turbomixer Corp Oval Coil Mixer or Equivalent
Exhaust and supply ventilation.	minimum exhaust rate of 250 cubic feet per minute and a maximum supply flow rate of 200 cubic feet per minute[18].

Training

5.15. Confined Space Entry Course. The Confined Space Entry Course conducted for members participating in the spray seal process met the requirements of training under DOHSMAN Chapter 7, Working in Confined Spaces. That said, FTRS was conducting its own confined space entry training for a period while assisting 82WG Field Training Flight with the development of their F-111 confined space entry course.

5.16. Spray Seal Process Training. After the trial in 1996, there was a hiatus of approximately nine months during which key people such as the NCO FTRS were moved. After 12 months, there were four remaining RAAF members who had been on site when the SM-ALC technicians were on site. Process training was on-the-job (OJT) under close supervision using mock-ups for some spray practice. Most witnesses felt this approach was appropriate given the nature of the task provided, of course, it was done conscientiously. Experience was gained on the simpler tasks before airmen were assigned to the more difficult applications, especially in confined spaces.

5.17. Hazardous Substance Training. Many of the chemicals used in the spray sealing process contain hazardous substances and the requirements for hazardous substance training are laid down in DOHSMAN[19]. DOHSMAN also contains the following guidelines for the content of both initial and refresher training:

a. 'labelling of containers of substances;
b. availability of, access to and how to interpret the information on the Material Safety Data Sheets (MSDS);
c. dangerous goods classification system and the nature of hazards within each class;
d. relevant reference documentation available within the workplace;

EXP.0001.001Statement of Kevin Andrew Spies in WGCDR Ross Report at page 32.
17 MAN.0103.001 Witness Statement of Russell Phillip Schoenfisch at par 12.
18 PUB.0005.001 (at 014), AAP 7214.003-292-5; 21 Jul 97 at par 5.
19 DOHSMAN Chapter 5, Hazardous Substance Management, Annex A at pars 37 and 38.

e. specific information about the hazardous substances to which employees may be exposed;
f. how hazardous substances are assessed and how the employee can help;
g. work practices and procedures to be followed in the use of hazardous substances;
h. measures used to control exposure to hazardous substances;
i. proper use and fitting of PPE;
j. procedures to be followed in the case of an emergency;
k. first aid and accident/incident notification and reporting procedures to be followed in the case of injury or illness;
l. nature of, and reasons for, any monitoring required and the availability of the results of such monitoring;
m. nature of, and reason for, any health surveillance required in order to detect the effects of exposure to hazardous substances;
n. employees' rights to be advised of the intention to introduce a new substance to which they may be exposed and the right to consultation in the assessment of such substances;
o. employees' rights and obligations in relation to health surveillance; and
p. legislative obligations.[20]'

5.18. Refresher Training. The formal requirement to conduct refresher training for the confined space entry course is in the DOHSMAN, which states:

a. 'Apart from the initial training, these employees will receive biennial continuation training and be subject to competency evaluations.
Note: The approved competency based training course for a competent person has a currency of two years. Employees successfully completing the course are to have these training details kept for the period of employment.
b. Assessment. All personnel involved in confined space operations are to be assessed biannually as competent persons by a supervisor accredited in conducting such assessment. The assessment should cover all aspects of the initial training syllabus. This assessment may indicate that the employee needs to undergo further training.
Note: A written record of each assessment conducted is to be maintained for the period of the person's employment.[21]'

Facilities

RAAF Spray Sealing Facility. The spray seal activity at Amberley was conducted in the 501WG Paint Shop, building 289. This hangar contains a whole of facility ventilation system but the practice was to often leave the doors open to allow hoses to be brought in for fuel tank venting. As well, a timer automatically regulates the ventilation system operation between 0645 and 1600. This meant that on the many occasions the spray seal process had to continue after hours it was done with the hangar ventilation system turned off. The system was also unreliable but breakdowns did not lead to suspension of the spray because of programming pressures[22].

USAF Facilities. USAF spray sealing at SM-ALC was done in a purpose built facility with appropriate ventilation and fume extraction.

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20 DOHSMAN, Chapter 5, Hazardous Substances Management at par 39.
21 DOHSMAN, Chapter 7, Annex D, Working in Confined Spaces, Appendix 8 at par 3-4.
22 See for example: WIT.0259.001, Witness Statement of Peter John Ruth at par 20; WIT.0273.001, Witness Statement of Dean Andrew Saunders at pars 15, 16 and 18; IOI.0001.151, Investigating Officer interview of CPL Saunders at question 63; IOI.0001.185 (at 205-206), Investigating Officer interview of CPL Fenech a Question 75; WIT.0015.001, Witness Statement of Shawn Patrick Anderson at par 21; WIT.0113.001, Witness Statement of Phillip Graham Gallagher at par 17.

CHAPTER 6 – THE WINGS DESEAL/RESEAL PROGRAM 1985 – 1992

EVENTS LEADING TO THE WINGS DESEAL/RESEAL PROGRAM

6.1. The wing integral fuel tanks were assembled using the same polyester faying surface sealant as in the fuselage tanks. However, a Dow Corning silicone sealant rather than the MIL-S-83430 polysulphide sealant was used for the fillet seal because silicone had better heat stability and was more flexible. While the polyester sealant 'reverted' and had the same hydraulic effect on the fillet seal as it had had in the fuselage tanks, it seems there was not the same chemical reaction with silicone as there was with the polysulphide sealant. Nonetheless, almost inevitably, the wing integral fuel tanks also reached the point where ad hoc fuel leak repairs became very time consuming and relatively ineffective.

6.2. The USAF had experienced similar problems to the RAAF. Using the USAF program as a guide, the Air Force commenced a test program in 1985 at RAAF Amberley. The resulting wings program ran until 1992, with 23 aircraft wing sets being reworked.

Extent of the Problem

6.3. The catalyst for the RAAF Wings Deseal/Reseal program was a defect report raised by 482SQN in July 1981. The nature of the defect was described as:

> 'During the past three to four years, the incidence of fuel leaks from F-111C wing tanks has increased in frequency. This Defect Report is raised to highlight the increasing maintenance effort being expended on repairing wing tank fuel leaks. Wing tank leak repairs can require expenditure of anywhere between a few manhours and, in the worst case, hundreds of manhours ...The net result of the increasing incidence of wing tank fuel leaks is increasing expenditure of manhours and decreasing on-line availability of the F-111C aircraft.[1]'

6.4. 482SQN recommended:

> 'Sealant reversion and breakdown of sealant around the fastener holes are both time/flying hours related. Thus the incidence of wing tank fuel leaks can be expected to increase if some type of limited or full wing deseal/reseal program is not implemented. It is recommended 3AD be tasked to carry out a prototype investigative deseal/reseal of one set of F-111C wings, involving removal of the upper wing skin to allow access and inspection, and determination of the extent of the deseal/reseal required. This program should be conducted on an aircraft concurrently with either an E Servicing or fuselage tank deseal/reseal.[2]'

6.5. This report was supported by Senior Engineering Staff Officer HQSC who had visited Amberley in June of that year[3]. AIRENG1D HQSC therefore commenced further investigations and noted that a prototype reseal had been conducted earlier:

> 'So far, the only F-111 wings which have been resealed are the spare wings purchased last year by the RAAF from the USAF. The opportunity was taken, during refurbishment of these wings, to perform a prototype reseal of the wing tanks while the wing skins were removed. These wings have now been in service for 4 months with no reported

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1 LAV.0008.124, Defect - Airframe – F111C Aircraft 482S/2531/A8/11-01/TECH (26); 01 Jul 81 at par 6.
2 LAV.0008.124, Defect - Airframe – F111C Aircraft 482S/2531/A8/11-01/TECH (26); 01 Jul 81 at par 10.
3 LAV.0040.006, Report on SENGSO visit to Amberley; 15 Jul 81.

fuel leaks. Until now, neither the RAAF nor the USAF has made any plans for programmed resealing of wing tanks.'[4]

Planning for a Wings Deseal/Reseal Program

6.6. USAF Activity. The supply and availability of a suitably qualified sealant posed a number of difficulties and a series of tests involving five laboratories was arranged by the USAF[5]. In September 1983, SM-ALC updated the RAAF on progress[6] and later advised it had commenced a wings deseal/reseal program that year[7].

6.7. RAAF Prototype. HQSC opted for a prototype using Dow Corning fluoro silicone sealant Q4-2817[8] with 3AD as the preferred location[9]. 3AD was subsequently tasked to commence the wings deseal/reseal (DR) program on A8-147[10] in early 1985. However, there was some delay in commencing due to difficulties in obtaining Q4-2817[11]. 3AD successfully completed the first wings DR in October 1985[12]. HQSC then sought clarification from SM-ALC on the use of products, product qualification, product compatibility, and perceived anomalies in techniques and procedures.

Wings DR Process

6.8. The main technical publications that relate directly to the wings DR program are:

a. AAP 7214.003-3-2B3 – Aircraft Structural Repairs F111 Aircraft, dated 4 July 1984, adopting USAF TO 1F-111A-3-23, titled Integral Wing Fuel Tank Deseal/Reseal Procedures;
b. AAP 7214.010-6-4-2 Work Sheets dated March 1986 which makes reference to USAF TO 1F-111A-3-23 but modifies the USAF procedures to reflect RAAF procedures; and
c. AAP 7214.003-292-4, which remained in draft form only, is based on USAF procedures but incorporates some of the RAAF modifications reflected in the work sheets.

6.9. The actual servicing was called F-111 Special Servicing 29 (S29) and work was conducted in accordance with AAP 7214.003-3-2B3 which covered USAF TO 1F-111A-3-23. This TO had itself been sourced from GD/FW 12AEI-200-1061. Of note however, is that the procedures employed varied from those specified, specifically: the TO called for softening agent (PR3107), which was not used, and did not specify seed blasting that was used. In determining the procedures used during the wing DR program, reliance has been placed on the AAP 7214.010-6-4-2 work sheets dated March 1986 which were issued by 3AD Maintenance Control Section (MCS)[13].

6.11. The broad process was (allowing curing time between steps when appropriate):

a. pressure test wing tank (5 psi air) to locate leak sites;
b. remove sealant from top plank fasteners by water pick to facilitate fastener removal;
c. wash all external surfaces using MIL-C-25769 (ED500) alkaline cleaner;
d. remove the top wing plank, a single piece machined from aluminium alloy, for tank access;

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4 LAV.0040.006, Report on SENGSO visit to Amberley; 15 Jul 81.
5 LAV.0040.020, AIRENGIO 2601/A8/129-2 Pt1(37) F111C Wing Refurbishment; 11 Apr 83.
6 LAV.0008.105, F111 Wing Deseal/Reseal Program; 22 Sep 83. LAV.0008.154, F111C Wing Refurbishment 2506/101/8/Tech Pt 1(80); 2 Jul 82.
7 LAV.0009.227, F111 Wing Deseal/Reseal Draft; 03 Jul 84.
8 AMB.0055.036, F111 Wing Deseal/Reseal Program; 07 Mar 84.
9 LAV.0009.227, F111 Wing Deseal/Reseal Draft; 03 Jul 84.
10 LAV.0004.009, F111 Wing Deseal/Reseal Program; 05 Feb 85.
11 LAV.0004.007, F111 Wing Deseal/Reseal Program; 26 Apr 85.
12 LAV.0007.087, Senior Logistics Engineer Officer Quarterly Report, Dec 85-Feb 86.
13 AMB.0040.001, TAM 26 Servicing Record Certificate RAAF; 02 May 89.

e. soak top panel removed fasteners in MIL-C-38736, brush clean, dry, then store;
f. remove injection hole screws, soak in MIL-C-38736, brush clean and reinstall;
g. remove fuel system components and plumbing from within wing tank;
h. remove 94-002 (and/or 94-009) silicone sealant and any exposed polyester faying surface sealant using a water pick/hydrolaser;
i. seed blast (walnut shell) the wing internal surfaces inside a tent within the FTRS hangar;
j. alternate MIL-C-38736 or MEK solvent scrub, plastic scrapers and hand picking using dental tools to remove all visible traces of removable sealant, with tradespeople working from above the work area;
k. repair tank surface paint as required using MIL-C-81706 Alodine, MIL-C-38736 solvent wipe and brushed MIL-C-27725 polyurethane paint;
l. inject MIL-S-83430 into injection grooves to express as much polyester sealant as possible and clean sealant residue using MIL-C-38736;
m. flush all voids with PR148, then pack lower voids with XA3598 epoxy and upper voids with MIL-S-83430 sealant;
n. prime epoxy surfaces of lower voids using EC 1945 B/A epoxy primer;
o. clean surfaces with MIL-C-38736 solvent then wipe on SS4004 silicone primer - there is a suggestion that at some point the surface was primed using Q4 heavily diluted using MEK;
p. apply two coats of Q4-2817 (AMS 3375) silicone sealant, class A by brush followed by class B with fillet gun, to all internal seams, lower voids and fastener heads/tails, wiping with MIL-C 38736 between coats;
q. for the pivot pylon which had not had fillet sealant applied at manufacture, the solvent cleaning of polyester sealant, PR148, XA3598 epoxy barrier and MIL-S-83430 two coat scheme was applied;
r. install fuel system components and plumbing;
s. prepare the top wing plank by wiping surfaces clean with MIL-C-38736, followed by PR148 primer and MIL-S-83430B6 polysulphide sealant along flange and bulkhead edges, and on faying surfaces;
t. wet reinstall the top plank using polysulphide sealant on fasteners;
u. leak test; and finally
v. clean structural gaps using MIL-C-38736, fill with MIL-S-83430 and smooth.

6.12. From an OH&S perspective, the great advantages with the desealing of the wings compared with the fuselage tanks was that the work was conducted from outside the tank. The hydrolaser was able to be used at waste height with the wing turned on its side (minimising debris and drainage issues) and, weather permitting, the wing could be moved to open air ventilation when cleaning with the solvents.

The Wings DR Program

6.13. The wing program ran between 1986 and 1992. The wings were worked on in pairs with each set taking about 16 weeks to complete. The workforce was a mixture of RAAF and civilian contract labour under RAAF supervision. The work was manpower intensive and conducted in hangar 277, a general-purpose aircraft maintenance hangar, with one corner curtained to contain the dust and debris from walnut blasting. Table 6.1 lists the wings that have undergone DR:

Table 6.1: Wing Numbers, Aircraft Tail Numbers and Deseal/Reseal Dates – Wing Process

Wing Serial Numbers		Aircraft Tail Numbers	Source
A1545	A1546	A8-146	A8-147 PAVE AUG 85
A1115	A1116	A8-135	A8-135 PAVE APR 86
A153	A154	A8-127	A8-127 R5&PAVE MAY 86

Wing Serial Numbers		**Aircraft Tail Numbers**	**Source**
A15295	A15296	A8-125	A8-114 PAVE SEP 86
A1529	A1530	A8-129	A8-129 R5&PAVE APR 87
W47389	W47390	A8-140	A8-140PAVE AUG 87
A15289	A1514	A8-130	A8-130 R5&PAVE SEP 87
A1535	A1536	A8-142	A8-142 PAVE MAR 88
A1527	A1528	A8-148	A8-148 R5&PAVE OCT 88
A155	A156	A8-145	A8-125 R4 DEC 88
A157	A158	A8-144	A8-144 R5 APR 89
A1511	A1512	A8-135	A8-145 R4 JUN 89
BA151	BA152	A8-134	EX USAF WINGS
A1519	A1520	A8-109	A8-109 R3&CMTC APR 89
A159	A1510	A8-134	A8-134 R5 MAY 89
A1539	A1540	A8-113	A8-113 R5 JUN 89
A1515	A1516	A8-132	A8-132 R4 FEB 90
BA153	BA154	A8-138	A8-138 R5&CMTC FEB90
A1541	A1542	A8-126	A8-126 R4&CMTC SEP 90
A1547	A1548	A8-143	A8-143 R5 DEC 90
A1521	A1522	A8-131	A8-131 R4 JUL91
A15283	A15284	A8-147	A8-147 R5 AUG 91
A1543	A1544	A8-114	A8-114 R5&CMTC MAY 92
A15121	A15122	A8-112	A8-112 R4 JUN 92

Equipment

Table 6.2 lists the equipment used in both the RAAF[14] and USAF[15] wing DR programs:

Table 6.2: Prescribed Equipment

Semco model 250 sealant filleting Gun
Plastic or metal spatulas
Bristle brushes
Semco model 507 sealant injection gun

Training

6.14. Hazardous Substance Training. Neither AAP 6700.001 nor DI(AF)PERS 56-15 contained specific guidelines for hazardous substance training. During the period of the wings program, the need for hazardous substance training was becoming more widely recognised in a general sense but no policy was formally applied to the wings workshop. For example,

[14] DI (AF) AAP 7214.003-3-2B3; 04 Jul 84.
[15] UTA.0001.013, USAF Technical Manual – T.O. 1F-111A-3-23; 01 Jun 84.

OHSMAN1 was first issued in 1987 and provided guidelines for hazardous substance training although the policy was only directed at Defence civilians. As well, AAP 7214.003-292-3 (13 September 1990 amendment) at paragraph 112[16] required training of fuel tank maintenance staff, however, this publication was only considered to apply to the fuselage programs.

6.15. **Wings Deseal/Reseal Process Training**. There was no formal requirement to conduct training on the wing DR process. Training was informal on-the-job under supervision, delivered by the more experienced corporals and LACs. A number of photographs were displayed in the section as a guide to the process. This training was generally considered adequate as the process was simple, although effort intensive.

Facilities

6.16. The wing DR program was conducted in Building 277 from inception until December 1989. The program then transferred to Building 278[17] but 278 was later allocated to the second DR program. The wings program then returned to Building 277[18]. Both hangars were fifty-year old Bellman general aircraft maintenance hangars. In response to a request in 1985 on the structural standard of each Bellman hangar, advice was that building 277 was in its basic condition and the only work done on building 278 had been adjustments to the top door tracks[19].

6.17. Emergency deluge showers were later installed in hangar 277 after an Environmental Health Survey stated that it was a necessity[20].

6.18. In September 1989, a 3AD submission for work on hangar 278 included upgrade of power supplies, a decontamination facility, a flammable goods store, deluge shower, refurbishment of existing luncheon/tea preparation areas, refurbishment of an existing equipment store, a concrete pad, external floodlighting, fire detection and drainage, and waste treatment[21]. Later correspondence to HQSC stated that the working conditions at the time in both hangars 277 and 278 were unsatisfactory[22]. Subsequently, a works requisition for the hangar refurbishment[23] was approved in February 1990 subsequent to funds being made available[24].

Evaluation of Wings Deseal/Reseal Program

6.19. As with the fuselage programs, the wing DR that was completed in 1992 proved of limited value. Some of the problems were that:

a. “the old polyester sealant could not be completely removed from all faying surfaces during the deseal process; and

b. the fluoro silicone sealant easily disbonds from the wing surface, a phenomenon that is aggravated by injection repairs to minor leaks”[25].

6.20 The fluoro silicone sealant readily compromised the bond strength of other materials.[26]

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16 PUB.0004.001 (at 014), AAP 7214.003-292-3 Deseal/Reseal of F111C Fuselage Fuel Tanks Health And Environment Quality Control and Equipment Operating Instructions.
17 LAV.0022.232, Refurbishment of Wing Deseal/Reseal Facility; 7 Sep 89 at par 1and LAV.0025.029, HQLCSORO(SCRO) 3AD/2506/68 Tech Pt 10 (48), Facilities Upgrade at Amberley for F111 Deseal/Reseal; 20 Feb 90 at par 4.
18 CBR.0019.260, SORO Minute SRO5/4600/A8C/1/4(38), Facilities for Deseal/Reseal Contract; 24 April 90.
19 AMB.0046.020, Amberley: Bellman Hangar No 340 – upgrading; 20 Aug 85.
20 AMB.0043.129 (at 130), Environmental Health Survey – 3AD Re/Deseal; 27 Feb 85 (estimated).
21 LAV.0022.232 (at 232), Refurbishment of Wing Deseal/Reseal Facility; 07 Sep 89.
22 LAV.0025.029 (at 031), Facilities Upgrade at Amberley for F111 Deseal Reseal; 20 Feb 90.
23 CBR.0017.117, Works Requisition; 02 Feb 90.
24 CBR.0017.116, Division 245/2/02 – 1989/90 Repairs and Maintenance Program – RAAF Base Amberley dated 29 Jan 90.
25 AMB.0009.109, Statement of Intention Wing Deseal Reseal Program; 01 Jan 93.
26 AMB.0009.109, Statement of Intention Wing Deseal Reseal Program; 01 Jan 93.

6.21 The incidence of leaks in wings with less than 18 months life after rework prompted planning for a second wing program incorporating improvements in processes and materials. Planning was well under way in 1996, possibly using the spray seal procedure that was being used on the fuselage tanks. However, funding for the second program was withheld due to a funding review of the Logistics Sub-Program[27].

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27 AMB.0002.001, Brief for OC501WG on the Fuel Leak and Status on the F111 Fleet; 15 Oct 98.

CHAPTER 7 - THE CHEMICALS, THEIR TOXICITY AND THEIR APPLICATION

SUMMARY

7.1. Annex A sets out in detail the chemicals used in the programs. Some of the chemicals were common to all programs, notably MEK (a cleaner/solvent), and PR1750 (a sealant). All chemical products used were as specified from equivalent USAF procedures, hence products were specifically demanded. For the first deseal/reseal program the desealant SR51, its supplement SR51A and the detergent ED500 were acquired directly from El Dorado Chemical Company. The remainder of the chemicals on that program and all subsequent programs were acquired through the normal RAAF supply system. The first fuselage program was the only program to use chemical desealing methods. All of the chemicals were managed according to RAAF chemicals management policy, and all of the chemicals used had a material safety data sheet (MSDS) with manufacturers' instructions, although these were not necessarily as complete as required now, or available to those handling the chemical products. The SR51 desealant used on the first program, the MMS425 spray sealant primer and the PR2911 sprayable sealant appear to be unique to the F-111 from a RAAF perspective.

7.2. A number of reports on toxicity were commissioned by the Board and in turn these were summarised by Mr Stefan Danek from the Defence Science & Technology Organisation in his report recorded here at annex D, and supported by his oral evidence given on 28 March this year. In his evidence, Mr Danek identified a number of chemicals used in the D/R processes which were both toxic and which produced a significant health risk for ground crew who may have inhaled some of the chemicals, or absorbed them through their skin, either because no, or inadequate, PPE was worn. Mr Danek noted that the risks were significantly exacerbated, in relation to inhalation, in confined spaces such as fuel tanks. Mr Danek also indicated possible adverse health effects which ranged from:

a. the <u>acute</u>, such as irritation, respiratory distress, nausea and nervous disorder; to
b. the <u>chronic</u>, such as dermatitis and possible ulceration; and to
c. the <u>systemic</u>, such as serious effects on the liver, kidneys, respiratory, nervous or cardiovascular systems.

7.3. Broadly speaking, the extent and adequacy of instructions and technical instructions relevant to the application of chemicals in the DR process improved over time.

7.4. Certainly, it came to be understood that the chemicals used in the DR and later the spray seal processes were considerably more toxic to those using them than had initially been thought. This later understanding is to be contrasted with, for example, the advice given to ground crew in relation to SR51 – the desealing fluid used in the first program. It appears that the material safety data sheet provided by the manufacturer of SR51 understated the toxicity of SR51 and considerably understated the need for PPE. Over time the extent and adequacy of instructions provided by the manufacturers and suppliers of the chemicals urged greater and in the light of subsequent scientific knowledge, more appropriate use of PPE. The Air Force did not add to those instructions, although, by the use of Australian Air Publications (AAPs) adopted those instructions.

THE CHEMICALS

7.5. Many of the chemicals used during the DR programs are classed as hazardous substances. Those chemical products specified by the DR process specifications and used regularly at various times are detailed at annexes A and B, and can be broadly grouped into desealants, solvents/cleaners, adhesion promoters/primers, and sealants. Of these, the ones most likely to have represented the greatest hazards are obviously those with higher toxicity, but also those used in the greatest volume and within confined spaces or poorly ventilated areas. Disregarding for the moment the Personal Protective Equipment (PPE) which was variously specified, available and used, the most notable chemicals were:

a. the chemical desealants SR51 and SR51A used on the first program;
b. the solvents, particularly MIL-C-38736 ('MILSPEC') and MEK;
c. the adhesion promoter PR148;
d. the epoxy barriers, being materials normally used as structural adhesives; and
e. the MMS 425 primer for the spray seal which contained strontium chromate and isocyanates;
f. the sealants, which contain proportions of solvents to assist working the sealant before cure, including:
g. the toluene based sprayable polythioether sealant PR2911,
h. PR1750 polysulphide sealant, and
i. Q4-2187 fluorosilicone sealant;
j. finally, aviation turbine fuel (AVTUR).

7.6. SR51 Desealant. The reputation of SR51 came before it. While there was some debate between the manufacturer, the USAF, MRL and the RAAF on toxicity, safe exposure limits, treatment of waste, etc, the clear warning was that the chemical and products of its waste were cause for concern requiring the implementation of special precautions. In theory, the desealant was to be used in a closed system which was to be thoroughly flushed after the SR51 had been used. In practice, the odour, at the very least, was ever present and traces of SR51 were evident even months and years later in aircraft that had been through the first program. A stigma applied to those employed on the deseal process because of the SR51 smell that attended them. They were barred, at least by weight of popular opinion, from many public areas on the Base because of their odour. The cinema and airmen's bar are but two examples.

7.7. Thiophenol Content of SR51. In 1981, when the RAAF was investigating differences with the USAF over process time and cleanliness of tanks after chemical deseal, MRL found RAAF stocks of SR51 and SR51A to contain 4 and 15 percent thiophenol respectively. This was to be compared with the specified 10 – 20 and 40 percent respectively, meaning RAAF stocks were less aggressive (and less toxic). Suggestions had been made around 1975, when the RAAF was planning the DR program, that Eldorado had experimented with the contents of SR51 and had varied them without changing the product identifier. However, Eldorado responded to the RAAF questions in 1981 by stating that the RAAF measurements were consistent with factory output, but did not comment on the apparent differences with their published specification. For the last two aircraft to undergo the 3AD program, additional drums of SR51A were used to boost the thiophenol strength, apparently consistent with SM-ALC practices. Measurements were not taken of actual thiophenol content after the additive was mixed.

7.8. Solvents. 'MILSPEC' solvent was regularly interchanged with MEK ('MILSPEC' contains 20% MEK) when the 'MILSPEC' was not available. These products were to be wiped on surfaces being prepared but were normally sprayed from squeeze bottles. These two solvents have been regularly used in the trades for a number of years. Tradespeople become familiar with the smell of these solvents and only the few with experience of the ill effects of high concentrations are naturally cautious. A 1987 report by the Department of Housing & Construction estimated Amberley units used 13,000 litres of MEK per year and 4,000 litres of 'MILSPEC' solvent; significant amounts by any measure. MEK/MILSPEC was also widely used in open baths for cleaning equipment and self.

7.9. Alkaline Cleaners/Detergents. All programs used alkaline cleaners well diluted with water and/or industrial detergents to rinse and clean the tanks after desealing. These products were worked using soft bristle brushes and were themselves rinsed using large quantities of warm water.

7.10. Metal Surface Finish. Alodine, paint primer and polyurethane fuel tank paint, conforming to MIL-C-27725, were applied as required by Surface Finishers to repair fuel tank metal surfaces. This mustering is well versed in handling and applying these products. Application was to selected, limited areas only.

7.11. Barriers. Products normally used as structural adhesives were used as epoxy barriers in an attempt to isolate the newly applied sealants from the ‘reverting’ polyester faying surface sealant. The same or very similar product has been used across all four programs.

7.12. Primers. The primers and adhesion promoters were used to promote adhesion of the barrier and sealant coats. PR148 was very similar in chemical composition to the MIL-C-38736 solvent and was used on the first and wings programs and at the start of the second program. The spray seal primer, MMS 425, contained strontium chromate, di-isocyanates and toluene and was sprayed in a poorly ventilated confined space.

7.13. Sealants. Sealants used in aircraft integral fuel tanks are broadly termed by application as either faying surface, fillet or structural void sealants. A polyester sealant was used as the faying surface and structural void sealant at manufacture and was the root cause of all the fuel leak problems. Two part polysulphide sealants were used as the original and replacement fillet sealant, and were also used as the faying surface sealant for those parts of the fuel tanks that had been disassembled; the wing upper surface plank being the most evident. Fluorosilicone sealants were used in the wings as the original and replacement fillet seal. Lastly, a polythioether sealant was adopted as the sprayable sealant in the most recent reseal program. This sealant it was hoped would be a panacea, applied over the top of all other sealants. All sealants used across the programs were used in large volumes once the reseal phase commenced. The two part sealants were mixed on site.

7.14. Fuel. Fuel is an obvious consideration. Although it is unlikely to have contributed in any significant way to toxic exposure to people working within FTRS (because of the small volume or limited time involved) exposure was nevertheless probable. Exposure could have occurred:

a. during removal of plumbing and components from the tanks because of residual fuel in fuel lines, and
b. later in the process when fuel was used for flushing and leak testing.

Chemicals Lists

7.15. Annex A to this chapter is a simplified listing of the chemical products used on each of the four programs. Annex B is a consolidated list of chemical products detailing the manufacturer/supplier of the product (where known) and their constituents.

Chemical Specification, Source and Supply

7.16. The supply system in the RAAF has undergone major changes over time. There has been a move away from central provisioning, to units being responsible for the provisioning of consumables and general supplies. The following sub-paragraphs describe the method of purchase currently employed at 501WG for chemical products, PPE and general stores:

a. An SQ230 (Internal Requisition) is raised which the respective team leader, (normally a SNCO) authorises.
b. The SQ230 is then processed through the 501WG Supply Section to the Purchasing Cell in 382SQN, for supply and delivery.
c. If the chemicals are not already identified, the request is processed through the Team Leader for endorsement by the WOFF in-charge of the section.

d. 382SQN Environmental Health Section must then endorse these new requests before the demand is passed to the respective Item Manager in SRLMSQN for approval.
e. Once approved, the item may be allocated a stock number to facilitate future orders[1].

7.17. There is no concern with the proper sourcing of the chemical products used in the DR programs. Each of the chemicals used was specified by the RAAF and purchased from authorised suppliers of the products. Some of these products were unique to the F-111 and adopted from USAF specified processes; others were generally in use across the RAAF. Material Safety Data Sheets (MSDS) are available, and mandatory now, for all products used in the programs, although the extent they were available and accessible during the first and wing programs particularly, and their accuracy over time, is erratic and far from clear. A selection of the more relevant MSDSs is included at annex C. Certainly, the term MSDS is now more a part of the vernacular than it was twenty years ago.

7.18. Specific comment on the source of some products for the first DR program is warranted. The involvement of the Eldorado Chemical Company was recommended from the start[2]. Eldorado made an initial proposal to provide equipment, personnel and chemicals to the RAAF in February 1976[3]. A senior Eldorado representative attended a planning conference in November of that year[4]. After discussions and an update from Eldorado on their proposal and answers to questions[5], a formal letter of offer was presented. Procurement became confused, with large purchase orders raised for chemicals without reference to the whole offer. Negotiations resolved the matter and a purchase order was finally raised for the Eldorado equipment[6].

7.19. One matter which is of some concern however, is the apparent practice of moving away from military or national material specifications towards product specification by manufacturer reference number alone. PR2911 and MMS 425 are evident examples. While this is principally a product performance issue, consistency of material composition cannot be assured and the application process may not be as tightly controlled, with possible unacceptable performance, OH&S or environmental consequences. The fact that these specifications relate more to product performance than to product constituents is acknowledged.

Chemical Toxicity

7.20. Practically all materials used in the desealing, cleaning, preparation and resealing processes were toxic, flammable and could have had both acute and chronic effects if proper handling, environmental control, or protective clothing was not exercised. While this might have been recognised, a false impression was created by people in authority frequently stating that the chemicals were safe to use when this was very much qualified by the then unstated: ‘provided the specified PPE is used’.

7.21. Toxicity and possible effect is a compound equation. The toxic hazard is dependent on the toxicity of constituent chemicals, volume of chemicals in use, the period of potential exposure, temperature and means of application (eg the amount of atomisation), and the nature of the workspace. Ventilation, particularly in the confined spaces of the fuselage fuel tanks, was critical to the control of chemical levels in the local atmosphere. As well, the extent of exposure necessary to cause adverse health effects cannot be stated with any accuracy because of individual tolerances and the insidious nature of chronic exposures.

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1 DI(AF)AAP 3031.003, Identification and supply of items not identified in the RAAF; 31 Oct 96 at Ch 2, s 6.
2 LAV.0016.009, F111C Project Integral Fuel Tanks Deseal/Reseal Program; 12 Mar 76.
3 LAV.0016.008, F111C Deseal/Reseal Program; 19 Mar 76 and LAV.0016.028, Deseal of F111C Aircraft 27 Feb 76.
4 LAV.0016.055, F111C Deseal/Reseal Facility Planning Conference and attachments; 8 Nov 76.
5 CBR.0025.011, Agreement with Eldorado for Supply of Equipment; 25 Jan 77.
6 LAV.0017.188, Commonwealth of Australia Treasury Regulations Purchase Order; 25 Jul 1977.

7.22. To make some sense of these variables, counsel assisting the Board commissioned a number of expert reports to be assessed and summarised by Mr Stephan Danek from MRL. The issues are complex and are best described by Mr Danek's full report which is included here at annex D. The summary at paragraphs 1.39 and 1.40, repeated below, is instructive, although the risk ratings can only be relative.

7.23. A desk top audit[7] identified all of the products employed in each of the 4 sealant programs, including solvent cleaners, alkaline detergents, primers, sealants.

a. First and Second Deseal/Reseal Program: 15 products.
b. Wing Deseal/Reseal Program: 13 products.
c. Spray Seal Program: 6 products.

Risk Rating

7.24. A risk rating was calculated for all Deseal/Reseal chemicals based on the hazard of the individual components and the likelihood of exposure. The risk rating is a score of 1 to 9 out of 9. While three formulations were assigned a high risk ranking (ie 7 to 9), most formulations were assigned a medium risk ranking (ie 4 to 6). A low risk ranking (ie 1 to 3) is considered to represent insignificant risk in terms of adverse health effects from their use, but do not imply the absence of risk. The products with the highest rating are shown in the table below together with an indication of the maintenance program in which each was employed[8].

Table 7.1: Risk Rating of Key DSRS Chemicals

Formulation	**Risk Rating**	**Risk Ranking**	**Usage in program**			
			First DR	**Second DR**	**Wing DR**	**Spray Seal**
SR51/A Desealant	9	HIGH	yes	no	no	no
PR-2911 Spray Sealant	9	HIGH	no	no	no	yes
MMS-425 Super Anzopon	9	HIGH	no	no	no	yes
Methyl Ethyl Ketone (MEK)	6	MEDIUM	yes	yes	yes	yes
MIL-C-38736	5	MEDIUM	yes	yes	yes	no
PR-148	5	MEDIUM	yes	yes	yes	no
PR-1750	5	MEDIUM	yes	yes	yes	yes
EC-2216 (Barrier)	4	MEDIUM	no	yes	yes	no
Q4-2817	4	MEDIUM	no	no	yes	no

Note: Although PR-148 was identified as a high risk formulation by Connell and Miller at page 79 of the report, it was only given a risk rating of 5 in Table 17[9].

7.25. Many of the substances used in the deseal/reseal programs had unpleasant odours, the worst usually assumed to be associated with the more toxic chemicals, and this often caused concern. However, in reality, the threshold level of olfactory detection for each of these chemicals was generally well below the health safe level. A quote from the Armstrong Report with respect to PM acetate, the solvent used in PR2911: '…. recommends an exposure limit of 100 ppm. They note, however, that at concentrations of 80 ppm, no human would be able to stand the "terrible stench".' This was also the case with SR51 where MRL staff, when commenting on concerns from staff at Amberley, said: 'Suggestions by BSQN staff that the burner be scrapped were premature and probably a natural outcome of the fears of handling a smelly liquid, the hazards of which had been exaggerated to an extraordinary

7 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01at page 79 and Table 3 at page 30.
8 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at Table 3 at page 30, page 79 and Table 17 at page 80.
9 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01at page 79 and Table 17 at page 80.

degree'. Along this line, a note in 292-5 records: 'The presence of chemical odours in the work area where the spray process is being performed does NOT automatically constitute a health hazard.' The problem with these statements is that a natural safeguard is nullified.

7.26. Spray Seal Program Comments. Of particular note is the occupational medicine report on Spray Sealing for the 501 Wing Investigating Officer which identifies the Armstrong Report as stating that the spray seal process can 'be done efficiently and safely … Excepting Strontium Chromate,'. However the former also questions the levels above the TLV for Isopropanol[10].

7.27. Cocktail of Chemicals. Some comment and speculation has been stirred up by the Inquiry on the possible, unexpected, toxic effect of a cocktail of chemicals used in these processes. Without extensive research, given the multitude of possible combinations, there would appear to be no reasonable way to measure this possibility. Interaction effects of multiple chemical exposures tend to be complex and the current understanding of them is incomplete. A known example of synergistic effect is the combined effect of the solvent (n-hexane) and methyl ethyl ketone (MEK). In combination, the effect on the nervous system of both these solvents is far greater than the additive effect of either of the substances acting alone. Thus for DR chemicals, mixtures of aliphatic hydrocarbons (e.g. fuel or petroleum solvents) and MEK have an attendant amplified risk. Notwithstanding, the likelihood of a more toxic effect is considered unlikely because most chemicals in use should have either cured or evaporated before the next step in the process was applied.

WARNINGS

7.28. Some typical cautions and warnings on toxicity, which became more common place from the late 1980s and are scattered throughout the various instructions, are:

a. 'The chemical desealing procedure…utilises…three agents or solutions which are major causes for concern…strict controls are required to protect the health of personnel…'

b. 'Methyl ethyl ketone…..vapours may be harmful. Avoid prolonged or repeated breathing of vapour. Avoid contact with skin and eyes. Do not take internally.'

c. 'Extremely bad cases of dermatitis can result from contact between skin and (sealant) accelerator. New type sealants have been known to cause dermatitis so severe that victims have had to have fingers removed.' (Quote from Fuel System training notes.)

d. 'Sealants are irritating to the skin and eyes upon contact and may emit harmful vapours. Use only with adequate ventilation or approved respirator. Avoid all skin and eye contact. Use protective clothing such as rubber gloves, apron and eye protection … Do not take internally.'

e. 'Most solvents are flammable … Vapours may be harmful. Use with adequate ventilation. Avoid prolonged or repeated breathing of vapour. Avoid contact with skin and eyes. Do not take internally … '

f. 'Cleaning solvent MIL-C-38736 is toxic and flammable. Avoid eye or skin contact or breathing of vapour. Protective equipment consisting of industrial goggles, rubber gloves and respirator is required. Irritation to eyes, skin, lungs, nose and throat or death may result if personnel fail to observe this warning.'

g. 'The chemical materials contained in the primer (MMS 425) and the sealant (PR 2911) are potent skin sensitizers. Prevention of skin contact is essential. The (TLV) of … desmodur with di-isocyanate (in PR2911), is 0.01ppm. Proper..(PPE) and compliance with the requirements specified herein are essential to prevent exposure.'

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10 EXP.0001.001 , WGCDR Ross Report at page 8.

7.29. Such warnings, by themselves, have not had the desired impact on tradespeople. Apart from not always being where they will be evident, there is the issue of being understood. Essentially, focus is on acute exposure which most would view as controllable and recoverable. The chronic effect of frequent low exposures however, generally isn't contemplated. Also, many warnings are very general in nature; e.g. usually quite non-specific regarding PPE. These warnings also have diminished credibility if they jump from cautioning symptoms of irritation to warning of possible death. While hazardous chemical warnings are now included in fuel tank repair worksheets, they are not required to be signed. If they were, a better compliance and education regarding the hazard might be achieved, even beyond well-controlled 'on-aircraft' work.

Instructions and Training on Chemical Application

7.30. Instructions on the application of chemicals were comprehensive and appropriate for the tasks (see chapter 9). The Air Force promulgated the procedures for the fuselage tanks based on GD(FW) and SM-ALC sourced material. The procedures for the wing tanks were drawn directly from a USAF technical order. Chemical manufacturers instructions related solely to information in MSDSs or on labels and were general in nature. Labels for the chemicals used on the earlier programs were not available for a judgment on adequacy to be made but the MSDSs were very basic and not generally known to the people on the hangar floor. No witness was able to give any definitive comment on the labels. The more recent labels and MSDSs were reasonably detailed and compliant with regulatory requirements.

7.31. Training in the handling and application of the chemicals was informal on-the-job training delivered by NCOs and experienced LACs. While generally adequate from a technical process point of view, the instruction failed to properly impress the toxic nature of the chemicals in use. This view is evidenced by the general lack of caution shown when handling the chemicals away from the aircraft, for example when cleaning equipment. A Hazardous Substance Course was initiated internally by 3AD in 1991 but records of its utility and longevity were not available.

ANNEXES

Annex A – Chemicals used on Each Program

Annex B – Chemicals Data

Annex C – Material Safety Data Sheets

Annex D – Danek Report

CHEMICALS USED ON EACH PROGRAM

1ST DESEAL / RESEAL PROGRAM

APPLICATION	PRODUCT	SPECIFICATION
DESEALANT	SR-51	FMS-1119
	SR-51A	
ALKALINE / DETERGENT WASH	AIRTECH 23	MIL-C-87936A
	ED-500	MIL-C-25769G
SOLVENT	ME767[1]	MIL-C-38736
	MEK	TT-M-261[2]
	T4460[3]	MIL-C-38736
METAL SURFACE PROTECTION	PR1560	MIL-C-27725
		MIL-P-23377
	DESOTO 823-707	MIL-C-27725
	Alodine 1200S	MIL-C-81706
BARRIER	XA3598 / (EC3580 B/A)[4]	
PRIMER / ADHESION PROMOTER	PR-148	P6140
SEALANT	PRO-SEAL 899	MIL-S-83430 FMS-1004[5]
	PR-1750	MIL-S-83430 AMS 3276[6]

2ND DESEAL / RESEAL PROGRAM

APPLICATION	PRODUCT	SPECIFICATION
SOLVENT	ME767 / (T4460)	MIL-C-38736
	MEK	TT-M-261[7]
METAL SURFACE PROTECTION	Alodine 1200S	MIL-C-81706
	DESOTO 823-707	MIL-C-27725
		MIL-P-23377
BARRIER	EC-3580 B/A	
PRIMER / ADHESION PROMOTER	PR-148	P6140
SEALANT	PR-1750	MIL-S-83430

1 ME767 was commonly referred to as “Mil-Spec”.
2 The prefix TT is used for US federal specifications.
3 T4460 was commonly referred to as “Mil-Spec”.
4 For subsequent programs XA-3598 became EC-3580 B/A. EC-3580 B/A did not contain asbestos.
5 The prefix FMS is used for Fort Worth Material Specifications.
6 The prefix AMS is used for Aerospace Material Specifications and replaces many Mil-Specs.
7 MEK was not used during the second Deseal / Reseal program save as an ingredient when mixing MIL-SPEC.

SPRAY SEAL PROGRAM

APPLICATION	PRODUCT	SPECIFICATION
ALKALINE / DETERGENT WASH	ZI-400	MIL-C-25769G
SOLVENT	MEK	TT-M-261
METAL SURFACE PROTECTION	Alodine 1200S	MIL-C-81706
BARRIER	EC-3580 B/A	
PRIMER / ADHESION PROMOTER	666-2003-427	MMS-425
SEALANT	PR-1750	MIL-S-83430
	PR-2911	AMS-3279
	PR-1826	

WINGS DESEAL / RESEAL PROGRAM

APPLICATION	PRODUCT	SPECIFICATION
ALKALINE / DETERGENT WASH	ED-500	MIL-C-257696
	AIRTECH 23	MIL-C-87936A
SOLVENT	MEK	TT-M-261
	T4460	MIL-C-38736
METAL SURFACE PROTECTION	Alodine 1200S	MIL-C-81706
BARRIER	EC-2216	
	EC-3580 B/A	
PRIMER / ADHESION PROMOTER	EC-1945 B/A	FMS-1058
	SS-4004	
	PR-148	P6140
SEALANT	PR-1750	MIL-S-83430
	QR-2817	FMS 1043 / AMS 3375
	94-002/9[8]	FMS-1043B/A

[8] FLUOROSILOCONE SEALANT was the original wing sealant and was a by-product of the water pick process.

TYPE	PRODUCT NAME	MANUFACTURER	DESCRIPTION	USE	APPLICATION	COMPONENTS
Adhesion promoter	PR 148	Eldorado Chemical Company		Prepare surface for application of sealant	Wiped with a cheesecloth	toluene 30-60%; distillate petroleum solvent dewaxed light naptha 10-30%; ethyl acetate 10-30%; MEK 10-30%; isopropanol 10-30%; tetraoctyl titanate as titanium(IV) 2-ethylhexoxide 1-10%
Avtur	Jet A-1 Containing FS II	BP Australia Ltd	Aviation Turbine Fuel	F-111 Fuel		A complex combination of hydrocarbons produced by the distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range C9 through C16.
Chemical conversion coating	Alodine 1200S		MIL-C-81706	treat exposed aluminium alloy	Applied with abrasive pad	chromium trioxide 54%; potassium fluoborate 20%; potassium ferricyanide (III) 10-60%; sodium flouride < 10%; potassium fluozirconate < 10%
Cleaner	AIRTEC 23	Gamlen	MIL-C-87936A	Alkaline cleaner for aluminium	1 part to 5 parts water; scrub surface with cleaner and a non-metallic soft bristle brush	octylphenol ethoxylate 1-10%; sodium dodecylbenzenesulfonate 1-10%; alcohols C9-11 ethoxylated 1-10%; sodium alkyl carboxylate 1-10%; sodium metasilicate (anhydrous) 1-9%; sodium hydroxide 0.1-1.9%; sodium nitrite 0.1-1%; water 30-60%
Cleaner	ED 500	Eldorado Chemical Company	MIL-C-25769G	SR 51 rinse		ethyl glycol monobutyl ether 5%; monophenol polyethylene glycol 9%; sodium doecyl benzene sulfonate 7%; distilled water 79%;
Cleaner	ZI 400		Alkaline wash	Wash tanks prior to spray seal	To produce cleaning mixture, 1 part ZI 400 is mixed with 10 parts water. Cleaning mixture is sprayed at a maximum pressure of 200 psi (1380 kPa)	alkylbenzene sulfonic acid as dodecylbenzenesulfonic acid < 10%;organic sulfonates (unspecified) < 10%; alcohol ethoxylate as alcohols C9-11 ethoxylated < 10 %; sodium xylene sulfonate < 10%; nonionic surfactant as polyethylene glycol mono-p-nonylphenyl ether < 10%; impurities (unspecified) < 1%; water (not spec)

TYPE	PRODUCT NAME	MANUFACTURER	DESCRIPTION	USE	APPLICATION	COMPONENTS
Desealing Fluid	SR 51	Eldorado Chemical Company		F1, F2, A1 and A2 fuselage tanks, 1st program	Fill desealant reservoirs, from which it is sprayed	Petroleum solvent (high flash aromatic) 60-90%; thiophenol 5-10%; Dimethyl acetamide 5-10%; triethyl phosphate 1-5%
Desealing Fluid Additive	SR 51 A	Eldorado Chemical Company		Additive to SR 51	Fill desealant reservoirs, from which it is sprayed	Petroleum solvent (aromatic) 80%; thiophenol 15%; Dimethyl acetamide 8%; triethyl phosphate 1%
Epoxy Barrier	EC 2216 B/A	3M Company	Two part epoxy compound	Barrier between reverted sealant and new sealant	use fillet or sealant injection gun	**Part A:** amine terminated polyether/ carboxylic acid reaction product 40-70%; kaolin 30-60%; carbon black < 0.1%; **Part B:** bisphenol A/ epichlorohydrin resin, liquid 70-80%; kaolin 20-30%;
Epoxy Barrier	EC 3580	Eldorado Chemical Company	Two part epoxy compound	Barrier between reverted sealant and new sealant	use fillet or sealant injection gun	**Part A:** polyaminopolyamide 40-70%; ball clay (kaolin), aluminium silicate 15-45%; silica dimethylsiloxane treated 5-10%; carbon black 0.1-1% **Part B:** bisphenol A/ epichlorohydrin resin liquid > 60%; ball clay 10-30%; silica, dimethylsiloxane treated 1-5%
Primer	EC 1945 B/A	3M company	Fort Worth material specification FMS-1058	Epoxy primer		**Part A:** isopropyl alcohol 40-50%; toluene 15-25%; MEK 15-25%; xylenes (O-,M-,P-isomers) 5-15%; ethyl benzene < 5%; ethylenediamine, N-(3- (trimethoxysilyl) propyl) < 5%; 2,4,6-tris (dimethylamino methyl) phenol < 5%; volatile organic content **Part B:** n-butyl acetate 15-25%; zinc chromate 10-20%; talc (containing asbestos) 10-20%; epichlorohydrin, bisphenol A, toluenediisocyanate polymer 20-30%; titanium dioxide 5-15%; MEK 5-15%; 2-ethoxyethyl acetate < 5%; lead chromate < 5%; cyclohexane < 5%; volatile organic content

TYPE	PRODUCT NAME	MANUFACTURER	DESCRIPTION	USE	APPLICATION	COMPONENTS
Primer	MIL-P-23377			Fuel tank paint primer		toluene 15%; isopropanol 2-propanol dimethyl carbinol 55%; xylene dimethylbenzene xylol 15%; ethyl benzene < 5%; polyamide resin 20%
Primer	MMS 425	Valspar	Epoxy Primer	Spray sealant primer	3 parts primer base to 1 part activator; Sprayed using manoeuvrable pressure pot	bisphenol A/ epichlorohydrin resin, solid 10-30%; inert pigments and strontium chromate 10-30%; n-butyl acetate 10-30%; MEK 10-30%; toluene 5-10%
Primer	SS4004	General Electric	adhesion promoter	fluorosilicone sealant primer	wiped	benzene < 0.02%; tetraethyl silicate 1-5%; acetone 10-30%; n-butyl alcohol 1-5%; isopropyl alcohol 10-30%; toluene 10-30%; (C10-13) alkylbenzenesulfonic acid, triethanolamine 10-30%; volatile organic compound
Sealant	PR 1750	Products Research Company	MIL-S-83430 Polysulphide	Fuel tank fillet sealant	Applied using a fillet gun or brush depending on part	**Part A:** hydrogenated terphenyls 30%; manganese dioxide 55%; diphenyl guanidine 1-5%; carbon black 10%; **Part B:** limestone 25%; titanium dioxide 1-5%; toluene 5%; MEK 10%; trichloropropane/ sodium polysulfide copolymer (not specified);

TYPE	PRODUCT NAME	MANUFACTURER	DESCRIPTION	USE	APPLICATION	COMPONENTS
Sealant	PR 2911	Products Research Company / Desoto	Two components: white (first coat) and black (second coat). Both the white and black types have two parts	Sealing fuselage integral fuel tank except wing carry through box	sprayed	**White Part A:** propylene glycol monomethyl ether acetate, alpha-isome > 60%; diethyltoluenediamine 1-10%; silica, dimethylsiloxane treated (not spec); titanium dioxide < 1%; White Part B: polyurethane prepolymer as polythioether polymer with H12MDI > 60%; monomeric methylene bis (4-cyclohexylisocyanate) 1-3%; propylene glycol monomethyl ether acetate, alpha-isome 1-20%; Black Part A: propylene glycol monomethyl ether acetate, alpha-isome > 60%; carbon black < 1%; diethyltoluene-diamine 1-10%; silica, dimethylsiloxane treated (not spec); polyether polyol extended (not spec); **Black Part B:** polyurethane prepolymer as polythioether polymer with H12MDI > 60%; monomeric methylene bis (4-cyclohexylisocyanate) 1-3%; propylene glycol monomethyl ether acetate, alpha-isome 1-20%;
Sealant	Q4-2817	Dow Corning	fluorosilicone sealant	Wing tanks fillet sealant	applied using fillet gun	methyltriacetoxysilane 2%; ethyltriacetoxysilane 3%; red iron oxide 33%; hydrophobic amorphous fumed silica 6%; methyl-3,3,3-trifluoropropylsiloxane hydroxy termi 54%;
Solvent	ME767	Explosives Factory Maribynong	MIL-C-38736	General purpose cleaner / solvent	Wiped or scrubbed	Aromatic naphtha 50 +/- 2.0%; ethyl acetate 20 +/- 1.0%; methyl ethyl ketone 20 +/- 1.0%; isopropanol 10 +/- 1.0%
Solvent	MEK		TT-M-261	General purpose cleaner / solvent	Wiped or scrubbed	methyl ethyl ketone 99.5-100%; water 0-0.5%

TYPE	PRODUCT NAME	MANUFACTURER	DESCRIPTION	USE	APPLICATION	COMPONENTS
Solvent	MIL-C-38736 Type II	Turco	Non-photochemical reactive solvent blend	General purpose cleaner / solvent	Wiped or scrubbed	ethyl acetate 35.5 +/- 1.0%; methyl ethyl ketone 36 +/- 1.0%; isopropanol 10 +/- 1.0%; toluene 18.5 +/- 1.5%
Solvent	Turco T4460	Turco	MIL-C-38736	General purpose cleaner / solvent	Wiped or scrubbed	Aromatic naphtha 50 +/- 2.0%; ethyl acetate 20 +/- 1.0%; methyl ethyl ketone 20 +/- 1.0%; isopropanol 10 +/- 1.0%

LIST OF MATERIAL SAFETY DATA SHEETS

1. SR 51
2. PR-2911 Black Part A
3. PR-2911 Black Part B
4. PR-2911 White Part A
5. PR-2911 White Part B
6. MMS-425 Primer
7. Methyl Ethyl Ketone
8. PR- 148 Adhesion Promoter
9. PR-1750 A 1/2 Part B
10. PR-1750 A 2 Part B
11. PR-1750 B 1/2 Part A
12. PR-1750 B 1/2 Part B
13. PR-1750 B 2 Part A
14. PR-1750 B2 Part B
15. EC 2216 B/A Part A Epoxy
16. EC2216 B/A Part B Epoxy
17. Q4-2817 Flourosilicone Sealant
18. EC-3580 B/A Part A
19. EC-3580 B/A Part B
20. Fuel, Aviation, Turbine Engine
21. Jet A-1 Containing FS II
22. Toluene
23. Toluene Diisocyanate
24. Toluene-2,4 Diisocyanate

SR-51, DESEALANT

2
1 0
COMB

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

MANUFACTURER'S NAME	ELDORADO CHEMICAL COMPANY, INC.
REGULAR TELEPHONE NO.	512-653-9323
FAX NO.	512-653-0825
EMERGENCY TELEPHONE NO.	1-512-653-2060
ADDRESS	P.O. BOX 34837, SAN ANTONIO, TEXAS 78265
CHEMICAL NAME OR FAMILY	PETROLEUM NAPHTHA
SHIPPING NAME (DOT)	FLAMMABLE LIQUID, N.O.S., 3 (CONTAINS: 150 NAPTHA, METHANOL) PGIII, UN-1993
TRADE NAME AND SYNONYMS	SR-51

AMB.0048.028

NOTE: Not intended for consumer use

II. HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	CAS NO UN NO.	%	OSHA PEL	ACGIH TLV	HAZARD
THIOPHENOLS	108985	5	NONE	.5ppm	IRRITANT LACRYMATOR
DIMETHYL ACETAMIDE	127195	8	10ppm	10ppm	VAPOR SKIN ABSORPTION, HAZARD
TRIETHYL PHOSPHATE	78400	1	NONE	10ppm	VAPOR SKIN ABSORPTION, HAZARD
PETROLEUM SOLVENT, AROMATIC	8030-30-6	80	NONE	100ppm	VAPOR HAZARD

III. PHYSICAL DATA

BOILING POINT, 760 mm Hg	380°F	MELTING POINT	N/A
SPECIFIC GRAVITY (H_2O=1)	.9	VAPOR PRESSURE	100mm @ 24°F
VAPOR DENSITY (AIR=1)	5	SOLUBILITY IN H_2O, % BY WT.	INSOLUBLE
% VOLATILES BY VOL.	80%	EVAPORATION RATE (WATER =1)	.5
APPEARANCE AND ODOR	THIN LIQUID, STRONG ODOR	pH (AS IS)	8
		pH AT DILUTION	N/A

IV. FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD)	170°F C.O.C.	AUTO IGNITION TEMPERATURE	800°F
FLAMMABLE LIMITS IN AIR, % BY VOL.	LOWER: 2%		UPPER: 15%

EXTINGUISHING MEDIA: FOAM, CO_2, POWDER

SPECIAL FIRE FIGHTING PROCEDURES: SCBA REQUIRED. WATER WILL FLOAT PETROLEUM SOLVENT

UNUSUAL FIRE AND EXPLOSION HAZARD: MAY LIBERATE SULFUR OXIDE OR HYDROGEN SULFIDE FUMES DURING COMBUSTION.

PRODUCT SR-51

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V. HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA		HAZARD	EFFECTS OF OVEREXPOSURE
ROUTES OF EXPOSURE INHALATION	Acute:	HIGH, VAPOR HAZARD	DIZZINESS, NAUSEA, FATIGUE, ASPHYXIATION
	Chronic:	MODERATE	MAY CAUSE ALLERGIC REACTION, DERMATITIS
SKIN CONTACT	Acute:	MODERATE	MAY CAUSE IRRITATION
	Chronic:	MODERATE	DERMATITIS MAY OCCUR, LIVER DAMAGE MAY OCCUR
SKIN ABSORPTION	Acute:	SLIGHT	IRRITATION OF SKIN
	Chronic:	SLIGHT	DERMATITIS MAY OCCUR, LIVER DAMAGE MAY OCCUR
EYE CONTACT	Acute:	CORROSIVE TO EYES	BURNS EYES IMMEDIATELY, LACRYMATOR
	Chronic:	SLIGHT	NO CHRONIC HAZARD EXPECTED

EMERGENCY AND FIRST AID PROCEDURES

EYES: FLUSH WITH WATER FOR 15 MINUTES, CONSULT PHYSICIAN

SKIN: REMOVE CLOTHING, WASH WITH SOAP & WATER

INHALATION: REMOVE TO FRESH AIR

AMB.0048.029

VI. REACTIVITY DATA

INCOMPATIBILITY (MATERIALS TO AVOID)	STRONG OXIDIZERS, REACTIVE METALS
HAZARDOUS DECOMPOSITION PRODUCTS	COMBUSTION WILL PRODUCE TOXIC SULFUR OXIDE FUMES

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: SOAK UP WITH ABSORBANT

DISPOSAL METHODS: USEPA HAZARDOUS WASTE NO.'S P-014

CONSULT FEDERAL, STATE AND LOCAL REGULATORY AGENCIES FOR PROPER DISPOSAL.

VIII. CONTROL MEASURES

SAFETY REQUIREMENTS	MATERIAL TRANSFER OR SPILL	MATERIAL USE
VENTILATION	100FT/MIN	100FT/MIN
RESPIRATORY	SCBA REQUIRED IF LIMITS EXCEEDED	SCBA REQUIRED IF LIMITS EXCEEDED.
EYE PROTECTED EQUIPMENT	FACE SHIELD OR GOGGLES	FACE SHIELD OR GOGGLES
GLOVES	RUBBER GLOVES	RUBBER GLOVES
OTHER EQUIPMENT	RUBBER APRONS & BOOTS	RUBBER APRONS & BOOTS
WORK PRACTICES	AVOID SKIN CONTACT	KEEP EQUIPMENT CLEAN; AVOID SKIN CONTACT.

PREPARED BY: PAT E. SMITH DATE PREPARED 3-29-94

SIGNATURE Pat E Smith

Summary for PRC-DESOTO PR-2911 BLACK PART A
CHEMWATCH 5018-66

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]
UN NO:	1263	DG Class:	3(3.2)	Pack Group:	III
Sch Pois:	None	EPG:	3C1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability:	2
Toxicity:	2
Body Contact:	2
Reactivity:	1
Chronic effect:	2

Flammable

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R10 R36
R21/22 R37 R42/43

S Codes: S16 S23 S39 S51

R Statements:

- Flammable.
- Irritating to eyes.
- *Skin contact and/or ingestion may produce health damage*.*
- *May produce discomfort of the respiratory system*.*
- *Possible respiratory and skin sensitiser*.*

** (limited evidence).*

S Statements:

- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear eye/face protection.
- Use only in well ventilated areas.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

OR

Issue Date: Wed 13-Oct-1999

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-2911 BLACK PART B
CHEMWATCH 5018-67

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1263	DG Class:	3(3.2)	Pack Group:	II
Sch Pois:	S6	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 2
Toxicity: 2
Body Contact: 2
Reactivity: 1
Chronic effect: 2

Flammable

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R10 R20 R36 R42/43
R21 R37 R67

S Codes: S16 S23 S36 S39

R Statements:

- Flammable.
- Harmful by inhalation.
- Irritating to eyes.
- May cause SENSITISATION by inhalation and skin contact.
- *Skin contact may produce health damage*.*
- *May produce discomfort of the respiratory system*.*
- *Vapours potentially cause drowsiness and dizziness*.*

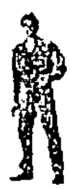
** (limited evidence).*

S Statements:

- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear suitable protective clothing.
- Wear eye/face protection.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS






Issue Date: Wed 13-Oct-1999

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-2911 WHITE PART A
CHEMWATCH 5018-71

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]
UN NO:	1263	DG Class:	3(3.2)	Pack Group:	III
Sch Pois:	None	EPG:	3C1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability:	2
Toxicity:	2
Body Contact:	2
Reactivity:	1
Chronic effect:	2

Flammable


Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R10 R20/21/22 R36
R37 R42/43
S Codes: S16 S23 S36 S39
R Statements:
- Flammable.
- Harmful by inhalation, in contact with skin and if swallowed.
- Irritating to eyes.
- *May produce discomfort of the respiratory system*.*
- *Possible respiratory and skin sensitiser*.*

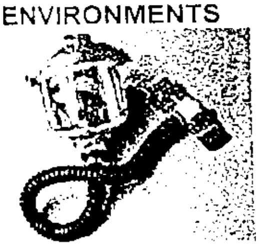
** (limited evidence).*

S Statements:
- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear suitable protective clothing.
- Wear eye/face protection.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS




OR



Issue Date: Wed 13-Oct-1999

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-2911 WHITE PART B
CHEMWATCH 5018-72

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1263	DG Class:	3(3.2)	Pack Group:	II
Sch Pois:	S6	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 2
Toxicity: 2
Body Contact: 2
Reactivity: 1
Chronic effect: 2

Flammable

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R10 R20 R36 R42/43
R21 R37 R67

S Codes: S16 S23 S36 S39

R Statements:
- Flammable.
- Harmful by inhalation.
- Irritating to eyes.
- May cause SENSITISATION by inhalation and skin contact.
- *Skin contact may produce health damage*.*
- *May produce discomfort of the respiratory system*.*
- *Vapours potentially cause drowsiness and dizziness*.*

** (limited evidence).*

S Statements:
- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear suitable protective clothing.
- Wear eye/face protection.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

Issue Date: Wed 13-Oct-1999

Print Date: Wed 13-Jun-2001

Summary for VALSPAR MMS-425 PRIMER 666-2003
CHEMWATCH 5018-63

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1263	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	Paint1 S6	EPG:	3C1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 3
Toxicity: 3
Body Contact: 2
Reactivity: 1
Chronic effect: 4

Flammable

Toxic

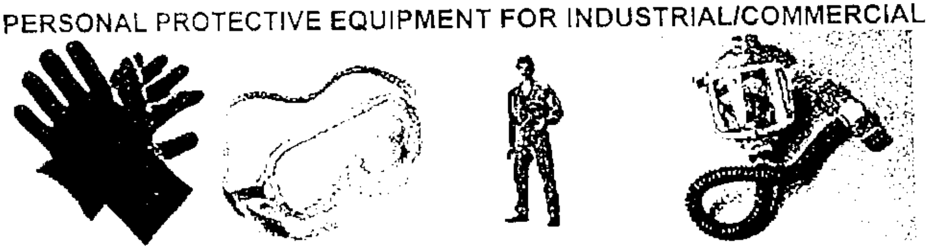
Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R11 R21 R25 R36/37/38 R43 R45(2) R65 R67
R42
S Codes: S1 S16 S9 S53
R Statements:
- Highly flammable.
- Harmful in contact with skin.
- Toxic if swallowed.
- Irritating to eyes, respiratory system and skin.
- May cause SENSITISATION by skin contact.
- May cause CANCER.
- HARMFUL-May cause lung damage if swallowed.
- Vapours may cause drowsiness and dizziness.
- *Possible respiratory sensitiser*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep away from sources of ignition. No smoking.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Tue 28-Sep-1999
Print Date: Wed 13-Jun-2001

Summary for METHYL ETHYL KETONE
CHEMWATCH 1193

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	78-93-3	NIOSH:	EL 6475000	HAZCHEM:	2[Y]E
UN NO:	1193	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	AS5 NZS4	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 3
Toxicity: 2
Body Contact: 2
Reactivity: 0
Chronic effect: 0

Flammable

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

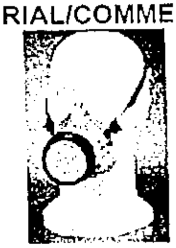
R Codes: R11 R36/37 R66 R67
R21 R38
S Codes: S16 S23 S39 S51
R Statements:
- Highly flammable.
- Irritating to eyes and respiratory system.
- Repeated exposure may cause skin dryness and cracking.
- Vapours may cause drowsiness and dizziness.
- *Skin contact may produce health damage*.*
- *May produce skin discomfort*.*

** (limited evidence).*

S Statements:
- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear eye/face protection.
- Use only in well ventilated areas.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Thu 12-Oct-2000

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-148 ADHESION PROMOTER

CHEMWATCH 5038-26 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1993	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	S6	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 3
Toxicity: 2
Body Contact: 2
Reactivity: 0
Chronic effect: 3

Flammable

Toxic

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

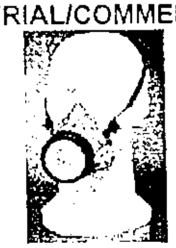
R Codes: R11 R20/22 R36/37 R45(2) R65 R67
R21 R38
S Codes: S1 S16 S9 S53
R Statements:
- Highly flammable.
- Harmful by inhalation and if swallowed.
- Irritating to eyes and respiratory system.
- May cause CANCER.
- HARMFUL-May cause lung damage if swallowed.
- Vapours may cause drowsiness and dizziness.
- *Skin contact may produce health damage*.*
- *May produce skin discomfort*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep away from sources of ignition. No smoking.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Wed 21-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 A-1/2, PART B
CHEMWATCH 50233 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1133	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	None	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability:	3
Toxicity:	1
Body Contact:	2
Reactivity:	1
Chronic effect:	2

Flammable


Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R11 R36/37 R65 R67
R21 R38 R42/43 R45(2)

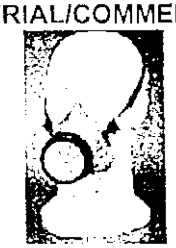
S Codes: S16 S9 S53 S29

R Statements:
- Highly flammable.
- Irritating to eyes and respiratory system.
- HARMFUL-May cause lung damage if swallowed.
- Vapours may cause drowsiness and dizziness.
- *Skin contact may produce health damage*.*
- *May produce skin discomfort*.*
- *Possible respiratory and skin sensitiser*.*
- *Possible cancer-causing agent*.*

** (limited evidence).*

S Statements:
- Keep away from sources of ignition. No smoking.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- Do not empty into drains.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Wed 14-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 A-2, PART B
CHEMWATCH 22402 **CD 2001/2**

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1133	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	None	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability: 3
Toxicity: 1
Body Contact: 2
Reactivity: 1
Chronic effect: 2

Flammable


Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R11 R36 R65
R37/38 R42/43 R45(2) R67
S Codes: S53 S401 S13 S26
R Statements:
- Highly flammable.
- Irritating to eyes.
- HARMFUL-May cause lung damage if swallowed.
- *May produce discomfort of the respiratory system and skin*.*
- *Possible respiratory and skin sensitiser*.*
- *Possible cancer-causing agent*.*
- *Vapours potentially cause drowsiness and dizziness*.*

** (limited evidence).*

S Statements:
- Avoid exposure - obtain special instructions before use.
- To clean the floor and all objects contaminated by this material, use water and detergent.
- Keep away from food, drink and animal feeding stuffs.
- In case of contact with eyes, rinse with plenty of water and contact Doctor or Poisons Information Centre.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

Issue Date: Wed 14-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 B-1/2, PART A

CHEMWATCH 53681 **CD 2001/2**

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability:	0
Toxicity:	2
Body Contact:	2
Reactivity:	1
Chronic effect:	2


Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

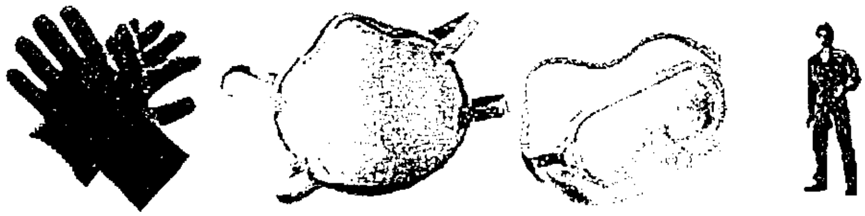
R Codes: R20/22
R37 R43

S Codes: S36 S51 S9 S401

R Statements:
- Harmful by inhalation and if swallowed.
- *May produce discomfort of the respiratory system*.*
- *Possible skin sensitiser*.*
- ** (limited evidence).*

S Statements:
- Wear suitable protective clothing.
- Use only in well ventilated areas.
- Keep container in a well ventilated place.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Wed 14-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 B-1/2, PART B
CHEMWATCH 53684 **CD 2001/2**

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability:	0
Toxicity:	1
Body Contact:	2
Reactivity:	1
Chronic effect:	2

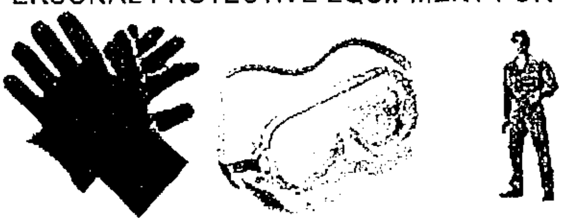

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R36
R37/38 R43
S Codes: S23 S24 S39 S401
R Statements:
- Irritating to eyes.
- *May produce discomfort of the respiratory system and skin*.*
- *Possible skin sensitiser*.*
- * *(limited evidence).*

S Statements:
- Do not breathe gas/fumes/vapour/spray.
- Avoid contact with skin.
- Wear eye/face protection.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Wed 14-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 B-2, PART A
CHEMWATCH 5038-09 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability: 1
Toxicity: 2
Body Contact: 2
Reactivity: 1
Chronic effect: 2

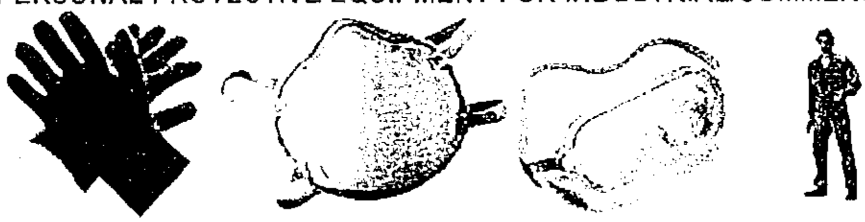

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R20/22
R37 R42/43
S Codes: S36 S51 S9 S401
R Statements:
- Harmful by inhalation and if swallowed.
- *May produce discomfort of the respiratory system*.*
- *Possible respiratory and skin sensitiser*.*
- ** (limited evidence).*

S Statements:
- Wear suitable protective clothing.
- Use only in well ventilated areas.
- Keep container in a well ventilated place.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Tue 20-Feb-2001
Print Date: Wed 13-Jun-2001

Summary for PRC-DESOTO PR-1750 B-2, PART B

CHEMWATCH 5038-10 **CD 2001/2**

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability:	0
Toxicity:	1
Body Contact:	2
Reactivity:	1
Chronic effect:	2

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R36
R37/38 R43
S Codes: S23 S24 S39 S401
R Statements:
- Irritating to eyes.
- *May produce discomfort of the respiratory system and skin*.*
- *Possible skin sensitiser*.*

** (limited evidence).*

S Statements:
- Do not breathe gas/fumes/vapour/spray.
- Avoid contact with skin.
- Wear eye/face protection.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

Issue Date: Wed 14-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for 3M SCOTCH-WELD EC-2216 B/A PART A GRAY EPOXY ADHESIVE
CHEMWATCH 13783

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	S5	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability:	1
Toxicity:	2
Body Contact:	0
Reactivity:	0
Chronic effect:	2

Harmful

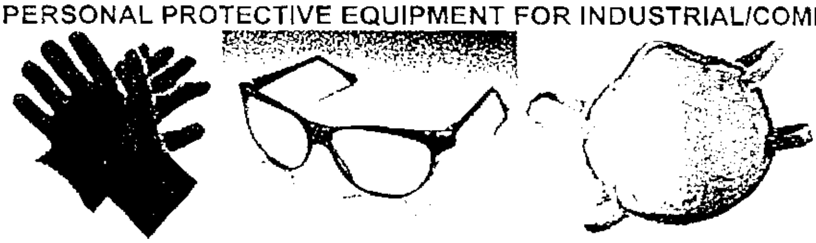
Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R48/20
R21 R36 R42/43
S Codes: S36 S39 S51 S9
R Statements:
- Harmful: danger of serious damage to health by prolonged exposure through
- *Skin contact may produce health damage*.*
- *May produce discomfort of the eyes*.*
- *Possible respiratory and skin sensitiser*.*

** (limited evidence).*

S Statements:
- Wear suitable protective clothing.
- Wear eye/face protection.
- Use only in well ventilated areas.
- Keep container in a well ventilated place.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Fri 23-Jun-2000

Print Date: Wed 13-Jun-2001

Summary for 3M SCOTCH-WELD EC-2216 B/A PART B GRAY EPOXY ADHESIVE
CHEMWATCH 12966 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	S5	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability:	1
Toxicity:	3
Body Contact:	2
Reactivity:	1
Chronic effect:	2

Toxic

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R20/21 R36/38 R43 R48/25
R37 R42 R45(2)
S Codes: S1 S9 S53 S401
R Statements:
- Harmful by inhalation and in contact with skin.
- Irritating to eyes and skin.
- May cause SENSITISATION by skin contact.
- Toxic: danger of serious damage to health by prolonged exposure if swallowed.
- *May produce discomfort of the respiratory system*.*
- *Possible respiratory sensitiser*.*
- *Possible cancer-causing agent*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS




Issue Date: Fri 23-Jun-2000

Print Date: Wed 13-Jun-2001

Summary for DOW CORNING Q4-2817 FLUOROSILICONE SEALANT
CHEMWATCH 20390

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability: 1
Toxicity: 4
Body Contact: 2
Reactivity: 0
Chronic effect: 0


Very Toxic

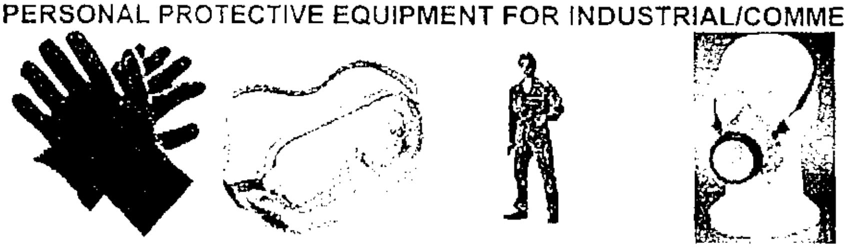

Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R28 R36/37
R38
S Codes: S1 S36 S38 S39
R Statements:
- Very toxic if swallowed.
- Irritating to eyes and respiratory system.
- *May produce skin discomfort*.*
- ** (limited evidence).*

S Statements:
- Keep locked up.
- Wear suitable protective clothing.
- In case of insufficient ventilation wear suitable respiratory equipment.
- Wear eye/face protection.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Mon 26-Mar-2001

Print Date: Wed 13-Jun-2001

Summary for SCOTCH-WELD EC-3580 B/A STRUCTURAL ADHESIVE (PART A)
CHEMWATCH 5506-97

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability: 0
Toxicity: 2
Body Contact: 2
Reactivity: 1
Chronic effect: 2

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R48/20
R22 R36/37/38 R42/43
S Codes: S36 S39 S51 S9

R Statements:
- Harmful: danger of serious damage to health by prolonged exposure through
- *Ingestion may produce health damage*.*
- *May produce discomfort of the eyes, respiratory tract and skin*.*
- *Possible respiratory and skin sensitiser*.*

* *(limited evidence).*

S Statements:
- Wear suitable protective clothing.
- Wear eye/face protection.
- Use only in well ventilated areas.
- Keep container in a well ventilated place.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS




Issue Date: Mon 10-Apr-2000

Print Date: Wed 13-Jun-2001

Summary for SCOTCH-WELD EC-3580 B/A STRUCTURAL ADHESIVE (PART B)
CHEMWATCH 5506-98 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	None
UN NO:	None	DG Class:	NONE	Pack Group:	None
Sch Pois:	None	EPG:	None	IERG:	None

CHEMWATCH HAZARD RATINGS

Flammability: 1
Toxicity: 3
Body Contact: 2
Reactivity: 1
Chronic effect: 2


Toxic


Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R20/21 R36/38 R43 R48/25
R37 R42 R45(2) R62
S Codes: S1 S9 S53 S401
R Statements:
- Harmful by inhalation and in contact with skin.
- Irritating to eyes and skin.
- May cause SENSITISATION by skin contact.
- Toxic: danger of serious damage to health by prolonged exposure if swallowed.
- *May produce discomfort of the respiratory system*.*
- *Possible respiratory sensitiser*.*
- *Possible cancer-causing agent*.*
- *May possibly affect fertility*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS




Issue Date: Mon 10-Apr-2000

Print Date: Wed 13-Jun-2001

Summary for FUEL, AVIATION, TURBINE ENGINE
CHEMWATCH 1863

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	None	NIOSH:	None	HAZCHEM:	3[Y]E
UN NO:	1863	DG Class:	3(3.2)	Pack Group:	III
Sch Pois:	S5	EPG:	3A1	IERG:	14

CHEMWATCH HAZARD RATINGS

Flammability:	2
Toxicity:	1
Body Contact:	2
Reactivity:	0
Chronic effect:	1

Flammable

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R10 R36/38 R65
R21/22 R37 R40(3) R67

S Codes: S16 S23 S36 S39

R Statements:

- Flammable.
- Irritating to eyes and skin.
- HARMFUL-May cause lung damage if swallowed.
- *Skin contact and/or ingestion may produce health damage*.*
- *May produce discomfort of the respiratory system*.*
- *Exposure may produce irreversible effects*.*
- *Vapours potentially cause drowsiness and dizziness*.*

* *(limited evidence).*

S Statements:

- Keep away from sources of ignition. No smoking.
- Do not breathe gas/fumes/vapour/spray.
- Wear suitable protective clothing.
- Wear eye/face protection.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

Issue Date: Tue 18-Jan-2000

Print Date: Fri 15-Jun-2001

BP AUSTRALIA LIMITED

MATERIAL SAFETY DATA SHEET

Jet A-1 Containing FS II

1. IDENTIFICATION OF PRODUCT AND COMPANY

Identification of substance/preparation
Jet A-1 Containing FS II

Application
Aviation turbine fuel

Company Identification
BP Australia Limited
A.C.N. 004 085 616
Melbourne Central
360 Elizabeth Street
Melbourne
Victoria 3000

AMB.0096.038

Telephone Number
61 3 92684111
Classified as hazardous according to the criteria of Worksafe Australia.
This MSDS consists of 6 pages. Please contact your BP representative for any additional copies.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Composition
A complex combination of hydrocarbons produced by the distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range C9 through C16.
CAS No. 8008-20-6
Contains small amounts of proprietary performance addives.
Hazardous Components

Diethylene glycol monomethyl ether (DGME) is present at 0.10 to 0.15 % as an icing inhibitor. This potentially hazardous material can reach high concentrations in water collected from aircraft tanks as a result of condensation.

3. HAZARDS IDENTIFICATION

Flammable liquid.
As the material has a low flash point, any spillage should be considered a potential fire hazard.
Spray applications increase the fire, and possible explosion, hazard.
Use in hot climates further increases this hazard.
This product may be aspirated on swallowing. Product may be irritating to the skin.

4. FIRST-AID MEASURES

Eyes
Wash eye thoroughly with copious quantities of water, ensuring eyelids are held open. Obtain medical advice if any pain or redness develops or persists.

Skin

Wash skin thoroughly with soap and water as soon as reasonably practicable. Remove heavily contaminated clothing and wash underlying skin.

Ingestion

If swallowed, do not induce vomiting, give a glass of water and contact a doctor or the Poisons Information Centre.

Inhalation

If fumes are inhaled, the patient should be removed to fresh air and if recovery is not immediate, medical assistance must be called without delay. If breathing has failed, respiration must be assisted, preferably by the mouth-to-mouth method (expired air resuscitation).

Medical Advice

Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment.
Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided.
Gastric lavage should be undertaken only after endotracheal intubation.
Monitor for cardiac disrhythmias.

5. FIRE-FIGHTING MEASURES

For major fires, call the Fire Brigade immediately. Ensure an escape path is always available from any fire. There is a risk of flashback if sparks or hot surfaces ignite vapour.
In case of fire, use foam, dry chemical, carbon dioxide, vaporising liquid or water delivered as a fine spray.
FIRES IN CONFINED SPACES SHOULD BE DEALT WITH BY TRAINED PERSONNEL WEARING APPROVED BREATHING APPARATUS.
Water may be used to cool nearby heat exposed areas/objects/packages. Avoid spraying directly into storage containers because of the danger of boil-over.

Combustion Products

Toxic fumes may be evolved on burning or exposure to heat.
See Stability and Reactivity, Section 10 of this Material Safety Data Sheet.

AMB.0096.039

6. ACCIDENTAL RELEASE MEASURES

Any spillage should be regarded as a potential fire risk.
In the event of spillage, remove all sources of ignition and ensure good ventilation.
Wear protective equipment. (See Exposure Controls/Personal Protection, Section 8 of this Material Safety Data Sheet for details)
Contain and recover liquid using sand or other suitable inert absorbent material.
It is advised that stocks of suitable absorbent material should be held in quantities sufficient to deal with any spillage which may be reasonably anticipated.
Spilled material may make surfaces slippery. Clean up spilled material immediately.
Recovery of large spillages should be effected by specialist personnel.
Protect drains from potential spills to minimise contamination.
Do not wash product into drainage system.
Vapour is heavier than air and may travel to remote sources of ignition (eg. along drainage systems, in basements, etc.).
If spillage has occurred in a confined space, ensure adequate ventilation and check that a safe, breathable atmosphere is present before entry.
In the case of spillage on water, prevent the spread of product by the use of suitable barrier equipment. Recover product from the surface.
Protect environmentally sensitive areas and water supplies.
In case of spillage at sea, approved dispersants may be used where authorised by the appropriate regulatory authority. In the event of spillages, contact the appropriate authorities.

Regular surveillance on the location of the spillage should be maintained.

7. HANDLING AND STORAGE

Handling Precautions

Ensure good ventilation and avoid, as far as reasonably practicable, the inhalation and contact with vapours, mists or fumes which may be generated during use. If such vapour, mists or fumes are generated, their concentration in the workplace air should be controlled to the lowest reasonably practicable level.
Avoid contact with eyes. If splashing is likely to occur wear a full face visor or chemical goggles as appropriate.
Avoid skin contact. Good working practices, high standards of personal hygiene and plant cleanliness must be maintained at all times.
Do not siphon product by mouth. Keep out of reach of children.
Whilst using, do not eat, drink or smoke. Wash hands thoroughly after contact.
Use disposable cloths and discard when soiled. Do not put soiled cloths into pockets.
Take all necessary precautions against accidental spillage into soil or water.

Fire Prevention

Light hydrocarbon vapours can build up in the headspace of tanks. These can cause flammability/explosion hazards, even at temperatures below the normal flash point.
Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electricity discharge and all ignition sources during filling, ullaging and sampling from storage tanks. Hoses should be electrically continuous.
Ensure equipment used is properly earthed or bonded to the tank structure.
Will present a flammability hazard if heated above the flash point but bulk liquids at normal storage temperatures present a low fire hazard.
If fuel contacts hot surfaces, or leaks from high pressure fuel pipes, the vapour and/or mists generated will create a flammability or explosion hazard.
Product soaked rags, paper or material used to absorb spillages, represent a fire hazard and should not be allowed to accumulate. Dispose of safely after use. Empty containers represent a fire hazard as they may contain remaining flammable residues and vapour.
Do not weld, heat or drill the container. Do not introduce an ignition source.
Heating may cause an explosion.

Storage Conditions.

Store and dispense only in well ventilated areas away from heat and sources of ignition.
Store and use only in equipment/containers designed for use with the product.
Containers must be properly labelled and kept closed when not in use.
Do not remove warning labels from containers. Empty packages may retain residual product; retain hazard warning labels on empty packages as a guide to their safe handling, storage and disposal.
Do not enter storage tanks without breathing apparatus unless the tank has been well ventilated and the tank atmosphere has been shown to contain hydrocarbon vapour concentrations below 1% of the lower flammability limit and an oxygen concentration of at least 20% by volume.
Always have sufficient personnel standing by outside the tank with appropriate breathing apparatus and equipment to effect a quick rescue.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits

Ensure good ventilation.
Avoid, as far as reasonably practicable, inhalation of vapour, mists or fumes generated during use.
If vapour, mists or fumes are generated, their concentration in the workplace air should be controlled to the lowest reasonably practicable level.

Protective Clothing

Wear face visor or goggles in circumstances where eye contact can accidentally occur.
If skin contact is likely, wear impervious protective clothing and/or gloves.
Change heavily contaminated clothing as soon as reasonably practicable and launder before re-use. Wash any contaminated underlying skin with soap and water.

Respiratory Protection
Respiratory protection is normally unnecessary, provided the concentration of vapour, mists or fumes is adequately controlled. If operations are such that the excessive generation and inhalation of vapour mist or fume may be anticipated, then suitable approved respiratory equipment should be worn.
The use of respiratory equipment must be strictly in accordance with the manufacturers' instructions and any statutory requirements governing its selection and use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical Values

Grades: Jet A-1
Containing FS II

	Test Method	Units	
Physical state			mobile liquid
Colour			pale yellow/straw
Odour			mild
Density @ 15°C	ASTM D 1298	kg/L	0.80
Boiling Point/Range	ASTM D 86	°C	150 - 280
Vapour Pressure @ 20°C	ASTM D 323	kPa	< 0.3
Flash point (PMC)	ASTM D 93	°C	> 38
Flammability Limits (%)			
LEL			0.7
UEL			5.0

AMB.0096.041

10. STABILITY AND REACTIVITY

Conditions to Avoid
Products of this type are stable and unlikely to react in a hazardous manner under normal conditions of use.
Hazardous polymerisation reactions will not occur. This material is combustible.

Materials to Avoid
Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products
Thermal decomposition can produce a variety of compounds, the precise nature of which will depend on the decomposition conditions.
Incomplete combustion/ thermal decomposition will generate smoke, carbon dioxide and hazardous gases, which will include carbon monoxide.

11. TOXICOLOGICAL INFORMATION

Eyes

Unlikely to cause more than transient stinging or redness if accidental eye contact occurs.

Skin

Likely to cause skin irritation.

Ingestion

Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea.

Inhalation

May cause irritation to eyes, nose and throat due to exposure to high concentrations of vapour, mists or fumes.

12. ECOLOGICAL INFORMATION

Mobility

Spillages may penetrate the soil causing ground water contamination.

Persistence and degradability

This product is inherently biodegradable.

Bioaccumulative potential

There is no evidence to suggest bioaccumulation will occur.

Aquatic toxicity

May be harmful to aquatic organisms.
Spills may form a film on water surfaces causing physical damage to organisms.
Oxygen transfer could also be impaired.

13. DISPOSAL CONSIDERATIONS

Dispose of via an authorised person/ licensed waste disposal contractor in accordance with local regulations, or if approved, allowed to degrade in situ.
Incineration may be carried out under controlled conditions provided that local regulations for emissions are met.
Dispose of product and container carefully and responsibly. Do not dispose of near ponds, ditches, down drains or onto soil.
Empty packages may contain some remaining product. Hazard warning labels are a guide to the safe handling of empty packages and should not be removed.

14. TRANSPORT INFORMATION

ADG - FUEL, AVIATION, TURBINE ENGINE, UN 1863, Class 3 - Flammable Liquid . Packaging Group III, 3(Y).

IMDG - KEROSENE , UN 1223, Class 3.3 - Flammable Liquid, Packaging Group III.

IATA/ICAO - FUEL, AVIATION, TURBINE ENGINE, UN 1863, Class 3 - Flammable Liquid, Packaging Group III.

15. REGULATORY INFORMATION

Worksafe Labelling

Risk

R22	Harmful if swallowed. Liquid may be aspirated into the lungs.
R38	Irritating to the skin.

Safety

S2	Keep out of reach of children
S24	Avoid contact with skin

Fire

S43	In case of fire use foam, dry chemical, CO_2, vapourising liquid or water delivered as a fine spray

First Aid

S46	If swallowed, contact a doctor or Poisons Information Centre immediately and show this container or label. If swallowed, do not induce vomiting. Give a glass of water.
S2	Keep out of reach of children.

Classified as a Harmful hazardous substance using the Worksafe Australia criteria.

Fuels are exempt from the Standard Uniform Schedule for Drugs and Poisons, except when packed in containers having a capacity of 20 litres or less. Classified as a Scheduled 5 (S5) Poison using the criteria in the Standard Uniform Schedule for Drugs and Poisons when used for other applications rather than as a fuel.

16. OTHER INFORMATION

Compiled by:

Health, Safety, Environment and Security Division,
BP Australia Limited,
A.C.N. 004 085 616
Melbourne Central
360 Elizabeth Street,
Melbourne, 3000
Victoria

AMB.0096.043

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Summary for TOLUENE
CHEMWATCH 1294

CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	108-88-3	NIOSH:	XS 5250000	HAZCHEM:	3[Y]E
UN NO:	1294	DG Class:	3(3.1)	Pack Group:	II
Sch Pois:	S6, NZS3	EPG:	3A1	IERG:	16

CHEMWATCH HAZARD RATINGS

Flammability:	3
Toxicity:	2
Body Contact:	2
Reactivity:	0
Chronic effect:	3

Flammable

Harmful

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R11 R20/22 R36 R65
R21 R37/38 R40(3) R61 R67

S Codes: S16 S9 S53 S29

R Statements:

- Highly flammable.
- Harmful by inhalation and if swallowed.
- Irritating to eyes.
- HARMFUL-May cause lung damage if swallowed.
- *Skin contact may produce health damage*.*
- *May produce discomfort of the respiratory system and skin*.*
- *Exposure may produce irreversible effects*.*
- *May be harmful to the foetus/ embryo*.*
- *Vapours potentially cause drowsiness and dizziness*.*

** (limited evidence).*

S Statements:

- Keep away from sources of ignition. No smoking.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- Do not empty into drains.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS

OR

Issue Date: Fri 30-Mar-2001

Print Date: Wed 13-Jun-2001

Summary for TOLUENE DIISOCYANATE
CHEMWATCH 2078-1 CD 2001/2

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	26471-62-5	NIOSH:	NQ 9490000	HAZCHEM:	2XE
UN NO:	2078	DG Class:	6.1(a)	Pack Group:	II
Sch Pois:	S6	EPG:	6.0.006	IERG:	39

CHEMWATCH HAZARD RATINGS

Flammability: 1
Toxicity: 3
Body Contact: 2
Reactivity: 2
Chronic effect: 3


Toxic


Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

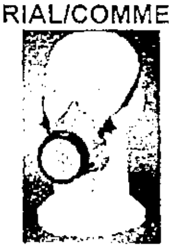
R Codes: R23 R36/37/38 R42/43
R21 R25 R45(2)
S Codes: S1 S9 S53 S401
R Statements:
- Toxic by inhalation.
- Irritating to eyes, respiratory system and skin.
- May cause SENSITISATION by inhalation and skin contact.
- *Skin contact may produce health damage*.*
- *Ingestion may produce serious health damage*.*
- *Possible cancer-causing agent*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS



Issue Date: Sat 17-Feb-2001

Print Date: Wed 13-Jun-2001

Summary for TOLUENE-2,4-DIISOCYANATE
CHEMWATCH 2078 **CD 2001/2**

HAZARDOUS ACCORDING TO WORKSAFE AUSTRALIA CRITERIA.
CONSIDERED A DANGEROUS SUBSTANCE ACCORDING TO DIRECTIVE 67/548/EEC, POINT 4; AND TO 29 CFP 1910-1200 (USA).

CAS RN:	584-84-9	NIOSH:	CZ 6300000	HAZCHEM:	2XE
UN NO:	2078*	DG Class:	6.1(a)	Pack Group:	II
Sch Pois:	S6	EPG:	6.0.006	IERG:	39

CHEMWATCH HAZARD RATINGS

Flammability:	1
Toxicity:	3
Body Contact:	2
Reactivity:	1
Chronic effect:	3


Toxic


Irritant

Scale: Min / Nil = 0, Low = 1, Moderate = 2, High = 3 and Extreme = 4.

R Codes: R23 R36/37/38 R42/43
R21 R25 R45(2)
S Codes: S1 S9 S53 S401
R Statements:
- Toxic by inhalation.
- Irritating to eyes, respiratory system and skin.
- May cause SENSITISATION by inhalation and skin contact.
- *Skin contact may produce health damage*.*
- *Ingestion may produce serious health damage*.*
- *Possible cancer-causing agent*.*

** (limited evidence).*

S Statements:
- Keep locked up.
- Keep container in a well ventilated place.
- Avoid exposure - obtain special instructions before use.
- To clean the floor and all objects contaminated by this material, use water and detergent.

PERSONAL PROTECTIVE EQUIPMENT FOR INDUSTRIAL/COMMERCIAL ENVIRONMENTS




OR


Issue Date: Fri 02-Mar-2001

Print Date: Wed 13-Jun-2001

DANEK REPORT

INTRODUCTION

C.1. Hazardous Substances. A hazardous substance is a substance that by its chemical and physical properties has the potential to harm the health or safety of persons in the workplace. Classification criteria are contained in Worksafe Australia Standard – 'Approved Criteria for Classifying Hazardous Substances' (National Occupational Health and Safety Commission (NOHSC): 1008 (1994)) and a list of hazardous substances is contained in Worksafe Australia Technical Report – 'List of Designated Hazardous Substances' (NOHSC: 10005 (1994))[1].

C.2. Purpose. The purpose of this summary is to consolidate the information obtained from expert reports on the hazardous substances used during the RAAF F-111 Deseal/Reseal Programs.

HAZARDOUS SUBSTANCES

C.3. There are approximately sixty (60) hazardous substances involved in all aspects of the Deseal/Reseal Programs. Of these the major risk chemicals are considered to be:

a. Methyl ethyl ketone (also methyl isobutyl ketone);
b. Aromatic hydrocarbons:
c. Toluene, and
d. Xylenes;
e. Naphtha;
f. *n*-butyl acetate;
g. Ethyl acetate;
h. Isopropanol;
i. Glycol ethers;
j. Thiophenol;
k. Isocyanates (HMDI Monomer); and
l. Chromium VI compounds, particularly strontium chromate[2].

BACKGROUND

Introduction

C.4. All substances will exert toxic effects as long as the dose is high enough[3]. To exert a toxic effect, the toxicant must enter the body and be distributed. The toxicity of a compound in a human population depends on several factors, including[4]:

a. the rates of entry and excretion;
b. the physical chemical properties of the chemical;
c. duration of exposure;
d. the compounds susceptibility to biotransformation;
e. Routes of Entry

C.5. In order for a chemical to exert a toxic effect, it must move from the ambient environment into the organism. There are three principal routes of entry for toxicants into the human body[5]. These are:

a. Inhalation through the respiratory system (lungs).

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1 DI(G) LOG 07-8, Management of Hazardous Substances except Dangerous Goods in Class 1 and Class 7; 10 Apr 97 at par 8b.

2 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 15 and Table 7.

3 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 16.

4 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at pages 14-16.

5 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 3-5.

b. Absorption through the skin.
c. Ingestion through the gastrointestinal tract (GIT).

C.6. Inhalation. The lungs are structured to maximise contact between atmospheric oxygen and blood to facilitate exchange. This also provides an excellent medium to exchange toxicants in the vapour or gaseous form in the atmosphere.

C.7. Absorption. Skin acts as a selective barrier to chemicals; the rates of permeation of different chemicals through skin vary significantly. In addition, the permeation rate through skin will vary depending on skin factors such as; skin condition, location of the skin on the human body, temperature of the skin, and hydration level of the skin (eg, dry or sweaty). For a given chemical, the permeation rate of the liquid will be higher than the permeation rate for the vapour.

C.8. Ingestion. The gastrointestinal tract (GIT) consists of the mouth, oesophagus, stomach, intestines and the rectum. A toxicant inside the GIT has not yet entered the human body. To enter the body, it must cross the lining of the GIT and enter the bloodstream. The major organs in the absorption of toxicants are the stomach and intestine walls, which are designed to maximise the absorption of food and thus are ideal sites for absorption of toxicants. The length of time that a toxicant stays in the GIT is very important, as increased exposure can lead to increased concentrations of the toxicant in the body.

Elimination of Chemicals

C.9. Elimination of chemical is a critical measure in minimising toxic effects[6]. There are three major routes for the excretion of toxicants; urinary, faecal and elimination through the lungs[7]. If a toxicant is biotransformed[8] (enzymatic transformation of toxicant into more reactive, water-soluble metabolites which undergo conjugate reactions with naturally occurring metabolic intermediates) to a water-soluble product the bulk of it will move into the aqueous component of the blood. Eventually, the blood passes through the kidneys where the aqueous component and the associated biotransformation product are removed and excreted in the urine. While in the body, either the original toxicant or the biotransformed compound can be transported to the site of action where toxic effects will be manifested.

C.10. Chemicals that are gases or are highly volatile (have high vapour pressures) can also be eliminated by the lungs.

Classes of Poisons Based on Effect

C.11. It is important to recognise that the type of toxic effect exerted varies with the type of chemical. Chemicals can be classified into different groups based on the type of deleterious effect they exert as described below.

C.12. Toxicants[9]. A toxicant can be defined as a chemical substance that causes a deleterious biological effect when living organisms are exposed to it. The type of toxic effect exerted will vary with the type of chemical. Some of the more harmful classes f toxicants include:

C.13. Teratogens. Any substance that causes defects in the reproduction process by either reducing productivity or leading to the birth of offspring with defects.

C.14. Mutagens. Any substance that leads to inheritable changes in the DNA of sperm or ovum cells.

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6 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 16.

7 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 7.

8 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 5.

9 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 7.

C.15. Carcinogens. Any substance that causes a cell to lose its sensitivity to factors that normally regulate cell growth and replication. Such cells replicate without restriction to form a growing mass called a tumour.

Dose-Response Relationships

C.16. For most chemicals, there are relationships between the biological effect observed and either the toxicant concentration in the ambient environment (for example, contaminants in air) or dose (total mass taken in) [10]. These relationships are collectively termed 'dose-response relationships'.

C.17. Individuals from a population of the same species have different susceptibilities (or tolerances) to toxicants. Those individuals affected at low levels are termed 'intolerant' or 'susceptible', while those that are only affected at much higher levels are termed 'tolerant' or 'non-susceptible'. The majority of individuals have a tolerance between these two extremes. The variation in tolerance is due to such differences as innate tolerance, rates of metabolism and body composition.

Measures of Toxicity

C.18. Measures. All measures of toxicity refer to either a concentration or a dose that causes a toxic effect[11]. Concentration-based measures of toxicity state the concentration in the surrounding environment (for example, air in inhalation tests) needed to exert the particular toxic effect. These concentrations are expressed in units such as $\mu g/m^3$ or ppm (in air). On the other hand, dose-based measures of toxicity are expressed on a mass per mass of organism tested basis, for example, milligrams of toxicant per kilogram of tissue (mg/kg body weight).

C.19. 50% Effect Levels. The principal measure of the toxic effects used in toxicity studies is the 50% effect level, where 50% of the individuals are more tolerant and 50% are less tolerant. This represents the average organism in the population and exhibits the greatest consistency in experimental measurements. For example, the concentration of a chemical, in the ambient environment that is lethal to 50% of the test organisms is designated LC_{50}.

C.20. Observed Effect Levels. In most situations in the general or workplace environment, sublethal levels are present, and so techniques are needed to address this[12]. Some of these utilise other measures of toxicity based upon statistically significant differences between treatments and the controls. Such measures are termed No Observed Effect Level (NOEL) or No Observable Adverse Effect Level (NOAEL), and Lowest Observable Effect Level (LOEL) or the Lowest Observable Adverse Effect Level (LOAEL).

Factors Affecting Toxicity

C.20. Factors. There is a wide range of factors that affect or modify the toxicity of chemicals. Some of these include[13]:

a. the sex of an organism which is largely related to the rate of metabolism and body composition;
b. composition of diet;
c. age and general health of the test organisms;
d. hormone levels (for example, pregnancy); and
e. experimental conditions under which the toxicity was determined.

C.21. The toxicity of a compound, at any given concentration, varies with the period of exposure. The relationship is such that as the period of exposure increases the amount of toxicant required

10 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 8.
11 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 8.
12 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 11.
13 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 14.

producing the necessary effect decreases. The minimum concentration that will exert a toxic effect, regardless of the period of exposure, is called the incipient or threshold toxicity of a chemical.

Human Health Risk Assessment

C.22. Risk can be defined as the probability of realization of a hazard resulting from exposure of a chemical or other agent[14].

C.23. Risk Assessment is a procedure for identifying hazards and quantifying the risks presented by contaminants to human health[15]. The Risk Assessment process consists of identifying the hazard involved, quantifying the exposure of human populations and natural ecosystems to the contaminant, evaluating dose/response relationships available for the chemical and finally characterising the risk involved using this information.

C.24. To quantitative a risk, we need to know the exposure to the chemical and the potency of the adverse effect. Thus:

$$\text{Risk} = \text{Hazard} \times \text{Exposure}$$ [16]

Data Available on Dose/Response Relationships

C.25. Exposure to toxic chemicals gives rise to a variety of possible responses in a population, depending not only on the nature of a chemical, but also on the dose and period of exposure that occurs[17].

C.26. In toxicology and risk assessment, the concentrations generally involved are in the low, probably more often very low, dose range and long exposure periods of months to many years. So, in these cases, the conventional toxicological techniques (LC_{50} and LD_{50}) for evaluating toxicity are more difficult to apply.

C.27. By combining the exposure with an indication of the adverse effects of that exposure, a characterisation of the risk posed by a particular chemical can be made. The dose/response data available to carry out this risk characterisation falls into two broad groups[18]:

a. Epidemiological evaluations of the effects on human populations.
b. Experiments conducted under controlled conditions on organisms in the laboratory.

C.28. **Safety Factor.** With human health evaluations, dose/response data can be obtained from epidemiological investigations or from experimental data from animals. To utilise these data, differences between the test population and the actual population being evaluated need to be taken into account[19]. With epidemiological data, this could be related to the age, activities and so on with different human populations, as well as lack of exposure data. With animal data, this relates to such factors as the difference in species, different exposure patterns and so on. The Safety Factor is applied in toxicity evaluations to increase the apparent toxicity and thereby account for these factors. It is important to note that the dose/response relationships are not absolute, as there are numerous limitations to both epidemiological data and animal experimental data.

State of International Knowledge on Chemicals

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14 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 19.
15 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 28.
16 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 19.
17 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 24.
18 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 24.
19 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 28.

C.29. History. Knowledge of Chemical hazards and effects in the workplace developed initially from animal studies using known toxic chemicals[20]. As the fields of occupational hygiene and occupational medicine expanded, hygienists began to record and document the health effects of chemicals on the workers using them. The greatest progress internationally was realised between 1970 and 1977 following the introduction in the USA of the Williams-Steiger *Occupational Health and Safety Act* (1970). During the 1970s, the fragmented occupational health bodies in many countries began to unify under a national body dedicated to occupational health and safety.

Australian Knowledge

C.30. Australian knowledge of chemical hazards, exposure and risks in industrial workplaces gradually developed through the organisation of government services in occupational health[21]. It should be recognised that Australia lagged many years behind in these developments compared to other countries, most notably the US. Occupational exposure standards may be used to reflect the state of scientific knowledge for particular chemicals at the time of their adoption. The first exposure standards in Australia were adopted in 1978.

Australian Workplace Exposure Standards

C.31. Current exposure standards for atmospheric contaminants in the occupational environment in Australia, or Workplace Exposure Standards (WES), are produced by the National Occupational Health and Safety Commission (NOHSC) [22]. The most recent edition was published in 1995.

C.32. The exposure standards represent airborne concentrations of individual chemical substances which, according to current knowledge, should neither impair the health of, nor cause undue discomfort to nearly all workers[23]. Worldwide, Threshold Limit Values (TLVs) set by the American Conference of Government and Industrial Hygienists (ACGIH) are the best known set of occupational exposure limits[24]. The TLV is the airborne concentration of a contaminant that is considered to be the level to which workers may be repeatedly exposed over an 8 hour working day, 5 days per week without experiencing adverse health effects. The documentation of the TLVs published by the ACGIH is an authoritative summary of the toxicological and epidemiological basis for the TLV. In Australia, the National Health and Medical Research Council (NH&MRC) adopted the full list of TLVs in 1983-1984. The exposure standards for airborne contaminants are expressed as a time weighted average (TWA) concentration of that substance over an eight-hour working day[25]. During periods of continuous daily exposure to an airborne contaminant, these TWA exposures permit excursions above the exposure standard provided that they are compensated by equivalent exposures below the standard during the working day.

C.33. Some substances also give rise to acute health effects following high short-term exposures although the primary toxic effects are due to long term exposure. Further restrictions have been placed on these substances in the form of Short-Term Exposure Limits (STELs) [26].

C.34. STELs provide guidelines for the control of short term exposure. They are established to minimise the risk of occurrence in nearly all workers of:

a. intolerable irritation;
b. chronic or irreversible tissue damage; and
c. narcosis to an extent that could precipitate industrial accidents.

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[20] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 20.
[21] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 52.
[22] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 56.
[23] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 56.
[24] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 32.
[25] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 56.
[26] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 57.

C.35. STELs are expressed as airborne concentrations of substances over a period of 15 minutes. This short term TWA should not be exceeded at any time during a normal eight-hour working day. Workers should not be exposed at the STEL concentration continuously for longer than 15 minutes or for more than four such periods per working day. A minimum of 60 minutes should be allowed between successive exposures at the STEL concentration.

C.36. Units of airborne concentrations. Airborne concentrations can be expressed in units of parts per million (ppm) or in terms of milligrams of substance per cubic meter of air (mg/m^3). One cubic centimeter (1 cm^3) of gas dispersed in one cubic meter of air (1 m^3 =1000000 cm^3) would have a concentration of 1 ppm.

Health Effects of Chemicals

C.37. Exposures to hazardous materials and chemicals may be acute or chronic. Acute exposures generally refer to single dose, high concentration exposures over short periods, while chronic exposures involve repeated or continuous exposures over long periods. These exposures may have acute, immediate or chronic long-term effects. Importantly, the extent of any health effects is dependent on a combination of three factors; the duration and frequency of exposure, and the concentration of the substance. This also depends further on the amount absorbed or internal dose of the substance.

C.38. Deseal/Reseal Chemicals. Most of the deseal/reseal chemicals (and jet fuels) identified have the potential to cause a diverse range of health effects related to the level and degree of exposures experienced during workplace activities or from the general environment.

C.39. The objective is to focus on those chemicals or mixtures of chemicals that may be of concern for personnel involved in the deseal/reseal procedures. The state of current information on the toxicology of individual chemicals is extensive and complex.

C.40. A desk top audit[27] identified all of the products employed in each of the 4 sealant programs, including solvent cleaners, alkaline detergents, primers, sealants.

a. First and Second Deseal/Reseal Program: 15 products.
b. Wing Deseal/Reseal Program: 13 products.
c. Spray Seal Program: 6 products.

Risk Rating

C.41. A risk rating was calculated for all Deseal/Reseal chemicals based on the hazard of the individual components and the likelihood of exposure. The risk rating is a score of 1 to 9 out of 9. While three formulations were assigned a high risk ranking (ie 7 to 9), most formulations were assigned a medium risk ranking (ie 4 to 6). A low risk ranking (ie 1 to 3) is considered to represent insignificant risk in terms of adverse health effects from their use, but do not imply the absence of risk. The products with the highest rating are shown in the table below together with an indication of the maintenance program in which each was employed[28].

Table C1: Risk Rating of Key DSRS Chemicals

Formulation	**Risk Rating**	**Risk Ranking**	**Usage in program**			
			First DR	**Second DR**	**Wing DR**	**Spray Seal**
SR51/A Desealant	9	HIGH	yes	no	no	no
PR-2911 Spray Sealant	9	HIGH	no	no	no	yes
MMS-425 Super Anzopon	9	HIGH	no	no	no	yes

27 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 79 and Table 3 at page 30.

28 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at Table 3 at page 30, page 79 and Table 17 at page 80.

Methyl Ethyl Ketone (MEK)	**6**	MEDIUM	yes	yes	yes	yes
MIL-C-38736	5	MEDIUM	yes	yes	yes	no
PR-148	5	MEDIUM	yes	yes	yes	no
PR-1750	5	MEDIUM	yes	yes	yes	yes
EC-2216 (Barrier)	4	MEDIUM	no	yes	yes	no
Q4-2817	4	MEDIUM	no	no	yes	no

Note: Although PR-148 was identified as a high risk formulation by Connell and Miller at page 79 of the report, it was only given a risk rating of 5 in Table 17[29].

C.42. High-risk ranking (9 out of a possible 9) were assigned to the SR51 desealant employed during the First Deseal/Reseal Program and the MMS-425 primer and PR-2911 sealant employed during the Spray Seal Program. The solvent cleaner MIL-C-38736 (risk rating 5) was employed extensively during the two fuselage tanks DR operations and the wing DR operation. MEK solvent (risk ranking 6) was employed during all four programs either in its pure form or as a component in formulations. PR-148 adhesion promoter and the PR-1750 polysulphide sealant were assigned medium risk ratings (5-6 out of a possible 9) and were employed largely in the first three DR Programs. Only relatively small quantities of PR-1750 were employed during the Spray Seal Program.

C.43. In the next section of this report, each of the nine formulations shown in the table will be considered individually in the following contexts:

a. A table listing the components of each chemical.
b. A table listing the state of the knowledge of exposure standards in Australia for the most hazardous components.
c. The health hazards for the components used in the formulations.
d. The potential exposure levels of each of the components derived from model based calculations or from direct contaminant monitoring. These will be determined for each of the work areas and programs in which the formulations were employed.
e. An assessment of the effect of exposure to the individual contaminants.
a. The solvents will be considered first as they are common ingredients in the primer and sealant formulations.

Composition of Formulations

C.44. A list of the components for each of the formulations is given as reported in the manufacturer supplied Material Safety Data Sheets (MSDS's) along with the percentage composition.

State of Australian Knowledge

C.45. The Australian exposure standards for the hazardous components that were published between 1978 to 1995 in the following reports are considered to constitute the state of Australian knowledge of the chemical hazards at that time[30,31]:

a. NH&MRC (1978) Hygienic Standards for Atmospheric Contaminates.
b. NH&MRC (1983-4) Threshold Limit Values.
c. NOHSC (1988) Draft Exposure Standards.
d. NOHSC (1991) Exposure Standards.
e. NOHSC (1995) Workplace Exposure Standards.

Health Hazards

C.46. The health hazards of the individual components in the formulations are detailed. In general, the solvents employed in the formulations were considered to constitute the greatest hazard to personnel on the basis of their volatility leading to exposure via inhalation. Many other components

29 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 79 and Table 17 at page 80.
30 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at page 58.
31 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 Table 7 at page 60.

though inherently toxic (for example, various fillers), constitute a lower health hazard as they are fixed in the formulations or are non-volatile, and are consumed in the curing reactions (eg epoxy resins, isocyanate prepolymer resins).

Estimation of Exposure Levels

C.47. Exposure levels to the Deseal/Reseal chemicals were obtained from the following sources:

a. Literature reports based on occupational hygiene monitoring of other aircraft maintenance activities or similar workplace exposures to the scenarios described by Connell and Miller.
b. Any monitoring data of airborne exposure levels during the sealing and resealing program (undertaken by SIMTARS).
c. Monitoring data derived from simulated trials of Deseal/Reseal activities.
d. Use of exposure models to predict exposure levels for inhalation.

C.48. From these information sources, daily doses of exposure to specific or higher risk chemicals can be estimated for workplace scenarios of interest or concern[32].

C.49. Potential airborne exposures predicted by modelling or indicated by monitoring trials, for many individual components of formulations could be readily discounted because levels are likely to be below applicable workplace exposure. Aerosol exposures to pigments, fillers, curing agents and polymeric materials are limited because of bonding, particulate sizes, low volatility and absence of mechanical ventilation dispersion[33].

MEK

Ingredients

C.50. MEK consists of the following ingredients:

Table C2: Components of MEK[34]

%	**Ingredient**	**CAS number**	**TWA/STEL**
>99%	**METHYL ETHYL KETONE (MEK)**	78-93-3	150/300 ppm

State of Australian Knowledge: Exposure Standards

C.51. The Australian state of knowledge through time for MEK, as indicated by the Australian Exposure Standards, includes the following:

Table C3: MEK Exposure Standards Through Time[35]

Name	**Date**	**TWA**		**STEL**		**Comments**
		Ppm	**mg/m^3**	**ppm**	**mg/m^3**	
MEK	1978	200	590			
	1983-4	200	590	300	885	
	1988	150	445			
	1991	150	445	300	890	
	1995	150	445	300	890	

Health Hazards

32 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 93.
33 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 122.
34 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 34.
35 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.

C.52. Methyl Ethyl Ketone (MEK). MEK has moderate toxicity following both acute and chronic exposures. The major route of occupational exposure to MEK is by inhalation, but absorption can also occur through the skin. Eye contact with the liquid can produce pain, irritation, and corneal injury. Slight nose and throat irritation may occur at 100 ppm, mild eye irritation at 200 ppm, and at 300 ppm the vapour is objectionable, with headache and throat irritation. Prolonged exposure to high atmospheric concentrations (350 ppm) may produce central nervous system depression and narcosis. Prolonged skin contact may defat the skin and produce dermatitis. No untoward effects have been reported for chronic exposure to low concentrations. IDLH Value (Immediately Dangerous to Life or Health): 3000 ppm.

C.53. MEK may enhance the neurotoxicity of *n*-hexane, but MEK has been found not to cause peripheral neuropathies itself. When present simultaneously with n-hexane, MEK can potentiate the neurotoxic effects of these compounds by an unknown mechanism. The neurological effects found from MEK, together with these other chemicals, include peripheral neuropathy (numbness, weakness, or tingling of the extremities) and central nervous system (CNS) depression (dizziness, unconsciousness, and loss of vision). Numbness of the fingers, arms and legs have been reported in workers exposed to 300 to 600 ppm, and polyneuropathy (a number of disease conditions of the nervous system) has occurred in workers exposed to MEK along with other substances[36].

Work Environment Hazard

C.54. General Information. MEK is a colourless liquid with a moderately sharp, fragrant, mint- or acetone-like odour. It is highly flammable and will be easily ignited by heat, sparks or flames and should be kept away from other combustibles, acids, and oxidising materials. MEK is also incompatible with amines, ammonia, inorganic acids, caustics, copper, isocyanates, pyridines, organic peroxides, radioactive materials, and copper. It reacts with hydrogen peroxide and nitric acid to form a heat and shock sensitive explosive product. Mixtures with 2-propanol produce explosive peroxides during storage. MEK will dissolve or soften some plastics. It reacts vigorously with chloroform and alkalis[37].

Estimations of Workplace Hazard

C.55. Workplace Scenarios. Connell and Miller estimated the possible exposure to personnel when using MEK in a variety of scenarios. These scenarios concentrated on ‘worst case’, involving no forced ventilation, with varying levels of natural ventilation and with varying usage rates of MEK. The results detailed below show that under these scenarios the concentration of MEK, inside the deseal hangar, would be below the recommended Exposure Standard. However, the levels inside the tank would be from approximately 25 to 100 times the Exposure Standard[38].

Table C4: Scenarios of Exposure to MEK[39]

Chemical	Exposure Levels (mg/m^3)	Hazard Index	TWA (mg/m^3)	STEL (mg/m^3)	Scenarios	Effect Levels
MEK	16-80	0.03-0.18	445	890	Hangar – one air exchange per hour High MEK use inside tank	Objectionable odour detection
	12500-50000	28.0-112			Inside tank – low ventilation Cleaner	Irritations and development of neurotoxic effects
	275600	619			Inside tank – saturated vapour concentration	Extreme value – unlikely Acute solvent effects

36 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 34.
37 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 34.
38 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 113.
39 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 28 at page 137.

C.56. Wing Tank Estimated MEK Concentrations. Connell and Miller estimate the possible air concentrations of MEK in proximity to an open wing tank in a hangar. The air concentrations were calculated for different scenarios in which the MEK usage rate was varied and for different mixing rates of the MEK vapours with the hangar air and with varying hangar air exchange rates. The results below show that, in all but the worst case, the MEK concentrations would be below the Exposure Standard[40].

Table C5: Predicted Air Concentrations of MEK[41]

Chemical	**Air Mixing Ratio (K)**	**Emission Rate (G) (g/hr)[1]**	**Predicted Air Concentrations (mg/m^3)**			
Air Exchange Rate (No. per hour)			**1**	**5**	**10**	**20**
Cleaner MEK	1	500	62.5	12.5	6.25	3
	0.5	500	125	25	12.5	6
	0.1	500	625	125	62.5	30
	1	1000	125	25	12.5	6
	0.5	1000	250	50	50	12
	0.1	1000	1250	250	125	62.5

Simulated Evaluation of Workplace Hazard

C.57. Cleaning Fuel Tanks. SIMTARS carried out monitoring studies of MEK in F-111 fuselage fuel tanks and in a controlled fume-cupboard environment[42]. The results were that short term excursions in concentration of MEK to levels up to 10 000 ppm measured in real time. However, TWA samples were much lower and generally below the NOHSC Exposure Standard[43].

C.58. The table below shows TWA concentrations of MEK measured during controlled cleaning of fuel tanks at selected locations inside the tank and on personnel. Personnel were instructed to spray the MEK, to then wipe with a rag and to wait until the alarm stopped sounding prior to respraying with MEK. The first entry below (434 ppm) is considered more representative of prior RAAF cleaning practices as during the operations the Eagle monitor was placed well away from the work area. This resulted in fewer stoppages due to the monitors' alarm sounding which in turn led to an increased usage rate of solvent. MEK exposure under these conditions is considered hazardous to personnel if not protected. For all other operations the Eagle monitor was close to the operating area resulting in a more controlled application rate.

Table C6: Sample Results[44]

Date	**Aircraft**	**Tank**	**Activity**	**Sample media**	**MEK (ppm)**
31/7/2000	135	F2	Spray	Tube	434
31/7/2000	135	F2	Spray	Badge	48
31/7/2000	135	F2	Spray	Badge	69
1/8/2000	135	F2	Stream	Tube	54
2/8/2000	135	F2	Stream	Tube	114
24/8/2000	146	F1	Spray	Tube	43
24/8/2000	146	F1	Spray	Badge	2
24/8/2000	146	F1	Spray	Badge	17
24/8/2000	146	A2	Stream	Tube	15
24/8/2000	146	A2	Stream	Badge	4
24/8/2000	146	A2	Stream	Badge	5
24/8/2000	146	F1	Stream	Tube	46

40 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 3 at page 28; and EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 119.

41 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 119.

42 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 and AMB.0017.056, SIMTARS, RAAF MEK spray test; 30 Mar 00.

43 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 11.

44 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 33.

24/8/2000	146	F1	Stream	Badge	2
24/8/2000	146	F1	Stream	Badge	16
24/8/2000	146	A2	Spray	Tube	13
24/8/2000	146	A2	Spray	Badge	5
24/8/2000	146	A2	Spray	Badge	7
16/8/2000	146	F1	Spray/Stream	Tube	54
16/8/2000	146	F1	Spray/Stream	Badge	33
16/8/2000	146	F2	Spray/Stream	Tube	29
16/8/2000	146	F2	Spray/Stream	Badge	15
16/8/2000	146	A1	Spray/Stream	Tube	51
16/8/2000	146	A1	Spray/Stream	Badge	53
16/8/2000	146	A2	Spray/Stream	Tube	186
16/8/2000	146	A2	Spray/Stream	Badge	58
		Exposure Standard			**150**

C.59. Measurements of MEK concentrations at the tank access gave values well below the Exposure Standard. These results suggest that possible exposure for personnel at the tank access (babysitter) is acceptable under these conditions[45].

C.60. Inhalation Risk. SIMTARS concluded that there was a moderate inhalation risk to personnel inside the tank and until ventilation was improved respiratory protection in the form of a full-face air-supplied breathing apparatus would be required[46].

C.61. Skin Absorption Risk. There is moderate skin absorption risk during MEK cleaning particularly in the aft tanks where highest transient spikes in MEK concentration were measured (up to 10 000 ppm) in real time using the gas monitor. Although the TWA readings were well under the accepted levels suggesting that MEK vapour is cleared from the tanks very quickly, SIMTARS conclude that there was insufficient evidence to definitively assess the risk. They further recommended the use of hand and body protection[47].

Equipment Cleaning

C.62. SIMTARS also assessed the concentrations of MEK during typical equipment cleaning activity. The levels of MEK were found to be extremely high, with an average concentration exceeding the TWA by a factor of 15. SIMTARS recommended that this practice be carried out in a fume cupboard[48].

Table C7: Assessment of MEK Gun Wash[49]

Sample Time (mins)	**Temp (°C)**	**MEK Concentration (ppm)**
28	21.3	>1897.3
5	27.2	1576.9
5	32.6	3391.1
Average		**>2300**
Exposure Standard (TWA)**		**150**
Exposure Standard (STEL)**		**300**

Dermal Exposure During Cleaning

C.63. Connell and Miller have estimated the average daily dose of MEK by absorption through the skin under conditions of immersion in liquid MEK and exposure to high MEK vapours[50]. The calculations show that intermittent contact with MEK could lead to an average daily dose of 60

45 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at pages 11 & 39.
46 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 10.
47 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 11.
48 SIMTARS, F-111 fuel tanks deseal/reseal - laboratory simulation; 20 Dec 00 at page 8.
49 SIMTARS, F-111 fuel tanks deseal/reseal - laboratory simulation; 20 Dec 00 at page 17.
50 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 125.

mg/kg/day, which is 100 times the reference dose (although there is low confidence in the reference dose data). Exposures to MEK vapours would lead to significantly lower average daily doses such that no significant effect would be expected.

Table C8: Estimated Skin Absorption Doses and Effects[51]

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m^3)	Scenario	Effect Levels
MEK - Vapour	0.0-2.0	<0.1-3.3	0.6	1.0	Cleaning of metal surfaces – low ventilation (hands, forearms and entire skin scenarios)	No significant effect expected
MEK - liquid	≈ 60	~100	0.6		Intermittent contact Hand and forearm intermittent contact	Exceeds developmental toxicity endpoints (confidence in RfD data is low)

Note: Hazard Quotient (HQ) = Average Daily Dose/Reference Dose (RfD)
RfC is Reference Concentration

Worker Exposure through Airlines

C.64. An investigation was conducted by Bromwich to evaluate the permeability of the PVC breathing airline, employed as part of the forced air breathing system, upon continuous exposure to liquid MEK (worst case scenario)[52]. It was determined that MEK will permeate through the intact walls of new hosing (breakthrough) within 30 minutes and even sooner in the case of used airline. Furthermore, it was found that the permeation rate increases substantially during a period of continuous exposure reaching a maximum steady state permeation rate of 666 mg of MEK per meter of hose after approximately 16 hours. The steady state permeation rate was found to be higher in the case of used hose (23% higher than for new hoses).

C.65. The scenario outlined above is unlikely given the amounts of MEK used, the method of application and its fast evaporation rate. There is yet no data for the permeation rate of MEK under normal conditions of exposure (ie to airborne MEK rather than liquid MEK).

C.66. Significance. While it has been shown that the airlines are permeable to MEK, the tests involved continuous exposure to liquid MEK and to a saturated MEK atmosphere. Neither of these tests are representative of workplace airline exposures. It is expected that the permeation rate of MEK would fall away significantly as the atmosphere concentration of MEK decreases. Accordingly the degree of exposure of personnel from contaminated airline is not quantifiable. More meaningful results would be obtained if the permeation rate of the airline were determined for concentrations of MEK representative of the workplace, eg 500 ppm.

Workers Exposed through Gloves

C.67. RAAF personnel working in fuel tanks used primarily Ansell Nitrile rubber gloves and also, when available, Butyl rubber gloves.

C.68. Nitrile type surgical gloves were evaluated for use with MEK by the Australian Government Analytical Laboratories, whereupon “the gloves failed catastrophically during testing”. Within 10 seconds of exposure to liquid MEK, the glove material was weakened to such an extent that it could

51 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 29 at page 139.
52 Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Esdan Airline; 29 Jan 01.

not hold the pressure required for the test process. It was concluded that the nitrile gloves were not considered suitable for usage with MEK due to the rapid degradation they exhibited[53].

C.69. Bromwich investigated the protection offered against MEK by Ansell Sol-Vex 37-185 Nitrile rubber gloves [54]. It was found that Ansell Sol-Vex gloves are unsuitable for use with MEK, with an average breakthrough time of four (4) minutes with continuous exposure[55]. They will give limited protection against occasional splashes for up to half an hour. If these nitrile rubber gloves are used in any formulation which has a significant (total $\geq$ 10%) fraction of chemicals that permeates or degrades the gloves, then the action of those chemicals on the gloves may permit other chemicals that the glove is designed for, to permeate. This includes all ketones and many aromatic hydrocarbons like benzene, toluene and xylene[56]. During cleaning operations inside fuel tanks, MEK is either directly sprayed onto tank structure and wiped off with a rag or applied via a rag dampened with MEK. Under these circumstances, it is reasonable to expect significant contact time of the glove with liquid MEK.

C.70. Samples of Butyl gloves were also tested by Bromwich with MEK to determine their permeation resistance[57]. Under the 'worst case' scenario of continuous exposure to liquid MEK, the chemical permeated in six hours rather than the published eight hours at 22^{o}C. The permeation rate for an eight-hour shift was considered relatively low, however, the permeation rate would increase substantially for the second consecutive shift. Caution was expressed in re-using the gloves, in addition the breakthrough time was found to decrease markedly at higher temperatures[58].

Workers Exposed Through Coveralls

C.71. Both the Dupont Tyvek Barrier Man and Tychem SL (Saranex) coveralls were tested for breakthrough times and permeation rates against MEK.

C.72. Tyvek Testing. [59] Testing of material from the Dupont Tyvek Barrier Man coverall showed that the suit offered no protection against MEK, with an almost instantaneous breakthrough time for the solvent. Similar results could be expected during exposure to other chemicals other chemicals. Examination of the surface of the suit under a microscope revealed a grid of non-penetrating pores, which facilitates 'breathing' but also minimises fluid resistance. Very limited splash protection would be provided against MEK or other solvents, including toluene.

C.73. Tychem Testing. [60] Testing of material from the Tychem SL (Saranex) coverall showed that the measured breakthrough time of 4 minutes for liquid MEK was shorter than the manufacturer published time. In addition the peak permeation rate (1.25 μg/cm^2/min) was found to be lower than the manufacturer published rate. The suit clearly offers some short-term splash protection. The permeation of the fabric to saturated MEK vapour was also investigated. The breakthrough time was much longer (75 minutes) and the steady state permeation rate was considerably lower (0.35 μg/cm^2/min) than for exposure to liquid MEK. However, liquid MEK can be expected to be in contact with a fraction of the area of the chemical suit and only intermittently, while vapour contact would be continuous[61]. Thus the large exposed area of a suit could lead to greater MEK exposures from vapour penetration than from liquid permeation. It is unlikely that personnel suited with Tychem coveralls would have been exposed to such extreme levels of MEK, namely saturated MEK vapour. While the permeation rate on exposure to more realistic levels of MEK were not investigated by Bromwich, it is expected that both the breakthrough time and permeation rate would be altered to the extent that the risk of dermal exposure through the suits would be significantly reduced. An additional complicating factor is that the permeation rate of vapour through the suit could increase upon exposure to liquid MEK.

Effects of MEK

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[53] AMB.0048.151, Australian Government Analytical Laboratories, Evaluation of Gloves for use with Methyl Ethyl Ketone for the Aeronautical and Maritime Research Laboratory, Oct 94.
[54] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Ansell Sol-Vex Gloves; 23 Jan 01.
[55] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Ansell Sol-Vex Gloves; 23 Jan 01 at page 11.
[56] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Ansell Sol-Vex Gloves; 23 Jan 01 at page 14.
[57] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Norton (North) Butyl Gloves; 22 Jan 01.
[58] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of Norton (North) Butyl Gloves; 22 Jan 01 at page 2.
[59] Bromwich D, Methyl Ethyl Ketone (MEK) Permeation of DuPont Tyvek Barrier Man Coveralls; 27 Jan 01.
[60] Bromwich D, Methyl Ethyl Ketone (MEK) Liquid and Vapour Permeation of Du Pont Tychem SL; 25 Jan 01.
[61] Bromwich D, Methyl Ethyl Ketone (MEK) Liquid and Vapour Permeation of Du Pont Tychem SL; 25 Jan 01 at page 22.

C.74. MEK is used as a solvent, usually in mixtures with acetone, ethyl acetate, toluene and/or alcohols. Exposure to 100-200 ppm MEK for 3-5 minutes has caused irritation of the eyes, nose and throat. A level of 300 ppm was found to be objectionable (NOHSC, 2000). Long-term neurotoxic studies in animals have shown that MEK alone is unlikely to cause peripheral neuropathy. Definite neurotoxic effects were not demonstrated in a study of Swedish steelworkers exposed to levels ranging between 150-450 ppm. Significantly, MEK can interact with some other solvents (e.g. n-hexane or methyl n-butyl ketone) to shorten the onset of neuropathy[62]. The Australian Exposure Standards Working Group recommends a TWA standard of 150 ppm and a STEL of 300 ppm to protect workers from possible neurotoxic effects, in the absence of other organic solvents[63].

Table C9: Predicted Exposures and Health Risks Using MEK[64]

Chem	Use	Apply	Loc	Predicted Exposure	Potential Effects	Risks of Effects	Assumptions/ Limitations	Uncert Factors
MEK	Clean	Spray bottle/ wipe	Tank	Inside tank: excessive levels (vapour and liquid) – very high	Severe irritations (eyes/ respiratory) Nervous system depression Neurotoxic effects Kidney/liver damage	High Medium High Low	Low ventilation Emission rate is constant and high Interaction effects are low Equilibrium concent	Low/ medium Uncertain Low High, possible over-estimate
MEK	Cleaner – equip clean	Batch/ 44 gal. Drum	Hangar	Vapour low Liquid contact	Odour Vapour irritations Skin irritations Systemic effects	High Low Medium to high Low	Hangar ventilation Emission constant No interaction Dispersion or vapours Readily skin absorbed	Low Medium Low Low

Estimated Significance

C.75. The use of MEK as a cleaner during the Deseal/Reseal and Spray Seal Programs may have resulted in over exposure of personnel. The degree of exposure is dependent on the personal, environment and usage variables discussed earlier. If high MEK usage rates were employed during the cleaning of fuel tanks, as a confined space, it is likely personnel were over exposed, particularly if adequate ventilation was not undertaken and PPE was not used correctly.

MIL-C-38736 (MIL-SPEC) SOLVENT CLEANER

62 EXP.0011.001, Anderson S, Connell D and Miller G, Appendix 1 - State of Knowledge - to State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 at page 104. [Also *www.worksafe.gov.au/databases/exp/az/methyl_ethyl_ketone_mek.htm*]

63 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.

64 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 31 at page 144.

Introduction

C.76. General. This section will look at the use of Mil-Spec (MIL-C-38736). Mil-Spec was used primarily in the First, Second and Wings DR Programs. Mil-Spec was used as a general cleaner both inside the fuel tanks and externally. Generally, the Type 1 Cleaner was employed which consists of a mixture of volatile solvents (aromatic naphtha, ethyl acetate, Methyl Ethyl Ketone (MEK) and isopropanol).

General Information

C.77. Composition. The ingredients of Mil-C-38736 includes the following:

a. Mil-Spec Type 1 aromatic naphtha 50% (or toluene); ethyl acetate 20%; methyl ethyl ketone 20%; isopropanol 10%.

b. Mil-Spec Type II ethyl acetate 35.5%; methyl ethyl ketone 36%; isopropanol 10%; toluene 18.5%[65].

State of Australian Knowledge: Exposure Standards

C.78. The Australian state of knowledge through time for the various components of the solvent cleaner, as indicated by the Australian Exposure Standards, include the following:

Table C10: Australian Workplace Exposure Standards of Mil-Spec Ingredients[66]

Name	Date	TWA		STEL		Comments
		Ppm	mg/m^3	ppm	mg/m^3	
Toluene	1978	100	380			
	1983-4	100	375	150	560	
	1988	100	375			Skin notice
	1991	100	377	150	565	
	1995	100	377	150	565	Review notice skin absorption
MEK	1978	200	590			
	1983-4	200	590	300	885	
	1988	150	445			
	1991	150	445	300	890	
	1995	150	445	300	890	
Ethyl Acetate	1978	400	1400			
	1983-4	400	1400			
	1988	400	1400			
	1991	400	1440			
	1995	400	1440			Change to 200 ppm (720 mg/m^3)
Isopropanol	1978	400	980			
	1983-4	400	980	500	1225	
	1988	400	980			Skin notice
	1991	400	983	500	1230	
	1995	400	983	500	1230	Review notice – sensory irritation

65 PUB.0004.001, DI (AF) AAP 7214.003-292-3, Chapter 2 at par 3.
66 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.

Name	Date	TWA		STEL		Comments
Aromatic Naphtha	1978					
	1983-4					
	1988	400	1600			
	1991					
	1995					

Health Hazards

C.79. Toluene. Toluene can be absorbed by inhalation and through the skin. At concentrations over 200 ppm, toluene can cause headache, depression, loss of coordination and memory, lassitude, and increased reaction time. At airborne concentrations of 300-400 ppm, toluene is a slight eye irritant, but even at 800 ppm the irritation is not severe. Exposure to toluene levels of 400 to 800 ppm can result in CNS excitation (euphoria, giddiness, tremors, nervousness, insomnia) followed by CNS depression (headache, dizziness, fatigue, muscle weakness, drowsiness, confusion, vertigo, decreased reaction time, nausea, loss of judgement and behavioural changes), metallic taste, and nausea. Lack of muscle co-ordination, severe fatigue, and seizures lasting up to several days have been reported after exposure to 800 ppm. At approximately 1 000 ppm intense headache occurs after 2-3 hours. Loss of consciousness and coma occur at exposures greater than 1 000 ppm. Rapid general anaesthesia follows exposure to 10 000 ppm or greater. Light exercise can double systemic absorption and increase risk of disturbed heart beat; hypoxia is often a factor. Symptoms of chronic exposure include peripheral neuropathy, personality changes, tremors, recurrent headaches, emotional lability, and memory loss. Toluene splashes in the eye cause a reversible superficial injury healing within 48 hours. Prolonged or repeated dermal exposure to the liquid may defat the skin. Repeated exposure has a cumulative effect on the nervous system[67].

C.80. Ethyl Acetate. Ethyl acetate is a primary irritant in acute exposure. Inhalation exposure can cause irritation of the eye, nose, throat, and upper respiratory tract. It can produce mild CNS depression. With inhalation exposure to greater than 2 000 ppm of ethyl acetate, it acts as an anaesthetic. It is metabolised to ethyl alcohol and acetaldehyde. Workers chronically exposed to between 34 and 78 ppm had lower platelet counts than controls. Ethyl acetate may cause corneal damage, may contribute to liver damage, and may impair the sense of smell. Prolonged skin contact with ethyl acetate may cause defatting dermatitis. Prolonged inhalation may cause lung, heart, liver, kidney damage, secondary anaemia, and leucocytosis. Workers exposed to ethyl acetate and other solvents had chronic bronchitis and reduced lung function. Workers regularly exposed to airborne levels of 375 to 1 500 ppm for several months had no unusual symptoms. Toluene may enhance the toxicity of ethyl acetate[68].

C.81. Aliphatic/Aromatic Hydrocarbons (Aromatic Naphtha). The hydrocarbons generally used in solvent cleaning are generally in the C_6 to C_{10} range. Prolonged inhalation or contact with material may irritate or burn respiratory tract, skin and eyes. Pulmonary aspiration of hydrocarbons can cause fatal chemical pneumonitis (HSDB). Inhalation of airborne concentrations of up to 400 ppm for 7 hours produced eye, nose, and throat irritation in human volunteers. Symptoms of Central Nervous System depression, such as headache, giddiness and fatigue were also noted. Other symptoms of CNS depression seen with hydrocarbon exposure are nausea, loss of coordination and judgement, and coma. Reduced attention span and manual dexterity were also observed. Tolerance may develop with chronic exposure. Repeated skin exposure may produce defatting dermatitis with drying and cracking[69].

C.82. Isopropanol. At the exposure standard isopropanol is a mild irritant to the eyes, nose and throat. Not classifiable as a carcinogen. Not a dermal irritant. As a central nervous system depressant isopropanol is about twice as potent as ethanol. Isopropanol potentiates carbon tetrachloride toxicity. Possible interaction with ethanol[70].

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[67] IOI.0052.040, SIMTARS, Non-spray sealed fuel tanks desk-top audit; 02 May 00 at pages 22-23.
[68] IOI.0052.040, SIMTARS, Non-spray sealed fuel tanks desk-top audit; 02 May 00 at pages 35-36.
[69] IOI.0052.040, SIMTARS, Non-spray sealed fuel tanks desk-top audit; 02 May 00 at page 36.
[70] IOI.0052.040, SIMTARS, Non-spray sealed fuel tanks desk-top audit; 02 May 00 at page 51.

C.83. Effects of Mil-C-38736 Formulation. This product consists of a mixture of volatile solvents (aromatic naphtha or toluene, ethyl acetate, Methyl Ethyl Ketone (MEK) and isopropanol). These solvents are rapidly absorbed via inhalation and skin contact and can readily irritate the skin, eyes and respiratory tract during short-term exposures. Longer exposures and higher levels can lead to Central Nervous System depression and respiratory effects. At levels of hundreds of parts per million in air, aromatic naphtha is more toxic than ethyl acetate, Methyl Ethyl Ketone and isopropanol. These levels may also produce dermal irritation, together with potential liver and kidney toxicity. This is primarily due to low-boiling aromatic hydrocarbons such as toluene and xylenes. Acute exposures are likely to be dominated by the effects of aromatic hydrocarbons because of their significant proportions in the formulation and potential additive effects from other solvents.

Assessment of Workplace Exposure

C.84. Workplace monitoring of airborne levels of the solvents in MIL-C-38736 was not undertaken and model calculations are also unavailable. However, MEK, isopropanol, and ethyl acetate are solvents common to both the cleaner and PR-148 adhesion promoter. The basic trends in the monitoring carried out for MEK (see earlier) and the model-based calculations of airborne vapour levels for MEK and PR-148 (discussed later) are expected to also apply for the solvent cleaner.

C.85. Wings Program. Accordingly, it is expected that only in the worst case scenario of poor mixing of solvent vapours from the wing with hangar air and high usage rates of cleaner would the workplace exposure standards have been exceeded in close proximity to the wing. The airborne concentrations in the open hangar are expected to have been well below the exposure standards.

C.86. Significance. It is considered unlikely that either personnel directly undertaking wing cleaning with MIL-C-38736 or personnel working in the open hangar would have been exposed to airborne solvent vapours in excess of the exposure standards. However, the additive effect of the various solvents would need to be considered.

C.87. Fuselage Tank Program. In the absence of mechanical ventilation, it is expected that extremely high concentrations of solvent vapours would have been present in the fuselage tanks during cleaning with MIL-C-38736 solvent cleaner. However, the concentrations of the individual components in the open hangar are expected to have been well below the exposure standards.

C.88. Significance. It is considered highly likely that personnel employing solvent cleaner in the fuselage tanks in the absence of mechanical ventilation and not wearing breathing protection would have been exposed to solvent vapours in excess of the exposure standards. However, with breathing protection and adequate ventilation, the risk of inhalation overexposure would have been significantly reduced.

Dermal Absorption.

C.89. The estimated the skin absorption doses for two components (MEK and toluene) of MIL-C-38736 and compared them with reference doses and effect levels. (see table below). It is concluded that the risk of significant skin absorption of solvent vapours is low. However, excessive liquid absorption is possible when cleaning with rags dampened with the solvent. The degree of absorption depends on the length and degree of exposure as well as its frequency. In a worst case scenario considered of intermittent hand and forearm contact with toluene, the reference dose was exceeded by a factor of 535.

Table C11: Estimated Skin Absorption Doses for Priority DRS Chemicals Compared with Reference Doses (US-EPA) and Effect Levels[71]

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m³)	Scenario	Effect Levels
MEK VAPOUR	0.0-2.0	<0.1-3.3	0.6	1.0	Cleaning of metal surfaces – low ventilation (hands, forearms and entire skin scenarios)	No significant effect expected
Liquid	≈ 60	~100	0.6		Intermittent contact Hand and forearm intermittent contact	Exceeds developmental toxicity endpoints (confidence in RfD data is low)
Toluene – vapour	0.02	0.1	0.2	0.4	Entire skin scenario, intermittent contact	No significant effects expected (possible neurotoxic effects)
Liquid	107	535	0.2		Hand and forearm intermittent contact	Possible changes in liver and kidney weights (animal studies) (NOAEL: 223 mg/kg-day)

C.90. Significance. The potential exposure of RAAF personnel to liquid MIL-C-38736 cleaner is a concern. If adequate hand protection was not employed significant skin absorption may have occurred. Dermal absorption coupled with inhalation exposure could have resulted in significant total body burden of the toxicants. The potential effects of the exposures are detailed in the table below.

Table C12: Predicted Exposures and Health Risks Using Mil-Spec[72]

Use	Chemical	Exposure	Potential Effects	Health Risks	Assumptions/ Limitations	Uncertain Factors
Wipe	Naphtha Ethyl acetate MEK Isopropanol	Inside tank: high to excessive liquid absorption	-Interactions, irritations -Central nervous system depression -Neurotoxic effects -Liver and kidney damage	-High -High -Medium -Low	Low ventilation Equilibrium concentrations Additive effects	Medium
Spray bottle	Naphtha Ethyl acetate MEK	Inside tank: high to excessive	-Interactions, irritations -Central nervous system	-High -High	Low ventilation Equilibrium concentrations Additive	Medium

[71] EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 29 at page 140.

[72] EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 30 at page 142.

Use	Chemical	Exposure	Potential Effects	Health Risks	Assumptions/ Limitations	Uncertain Factors
	Isopropanol	liquid absorption	depression -Neurotoxic effects -Liver and kidney damage	 -Medium -Low	effects	

SR51/SR51A CHEMICAL DESEALANT

Introduction

C.91. General. This section will look at the use of SR51 and SR51A, thiophenol based chemical desealants employed during the first DR program. The desealant was heated at 50^{o}C and circulated throughout the fuselage tanks for 48 hours under which conditions the bulk of the sealant was removed or dislodged[73]. The residual, softened sealant was subsequently removed by water blasting. The use of SR51/A commenced in 1978 and ceased in 1982. Incineration of used SR51/A commenced at Amberley during 1979/80 as a waste control measure, however, a considerable quantity remained on site at Amberley (stored in barrels) until the late 1980's.

C.92. Composition. The formulations of SR51 and SR51A were similar, the latter having a higher proportion of thiophenol. The full compositional data are as follows:

Table C13: Exposure Standards of SR51/A Components[74]

SR51	SR51A	Ingredient	TWA/STEL
60-90%	80%	Petroleum solvent (high flash aromatic)	400 ppm
5-10%	15%	Thiophenol	0.5 ppm
5-10%	8%	Dimethyl acetamide	10 ppm/15 ppm
1-5%	1%	Triethyl phosphate	Not available

Health Hazards

C.93. General. The major health risk associated with SR51 was considered to be the thiophenol. Although the presence of volatile aromatic hydrocarbons in the formulation was recognised as a complicating factor in the toxicity assessment, exposure to this solvent was not explored further in the report by Miller into the toxicity assessment of SR51 waste disposal[75]. In a separate report, Connell and Miller state that "*the offensive odour of thiophenol is also likely to prevent excessive exposure to aromatic naphtha components*.[76]" The less abundant components in the formulations, namely dimethyl acetamide and triethyl phosphate, were also not considered in the exposure assessments.

C.94. Thiophenol (Phenyl Mercaptan). Thiophenol is a severe skin, eye, respiratory and digestive system irritant. Burns or lung damage may occur. Headache, dizziness, coughing, dyspnea, nausea, and vomiting can occur from overexposure. CNS stimulation followed by CNS depression has been produced in animals. Thiophenol has a pronounced soporific (sleep-inducing) effect. Dermatitis may be produced from prolonged or repeated contact with the skin. Symptoms may be delayed by several hours[77].

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[73] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 4.
[74] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 1. and EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.
[75] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 3.
[76] EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 68.
[77] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 3.

C.95. Earlier toxic effects have also been briefly described as depression of the CNS respiratory paralysis, dermatitis and eye irritation including corneal ulceration[78]. Reported effects due to chronic exposures appear related to its objectionable odour, skin irritant properties and capacity to produce dermatitis from prolonged or repeated contact with the skin. Any chronic respiratory effects have not been clinically related. In comparison with the aromatic naphtha constituents such as toluene and xylenes, the current workplace exposure standard (TWA) for thiophenol is set at a low level (0.5 ppm) which reflects its odorous and irritant hazards at low levels of exposure. The US Library of Medicine database for thiophenol notes that thiophenol has been used in aircraft maintenance and production without reports of chronic effects.

C.96. White Spirit (Petroleum Ether). The term white spirit applies to the hydrocarbons in the C_7 to C_{12} range with a boiling point between 160 and 210°C. White spirit is also called stoddard solvent. White spirit vapour is an irritant of the mucous membranes and respiratory tract. A wide range of CNS symptoms are exhibited. These symptoms may include headache, giddiness, fatigue, loss of coordination and judgement, coma, reduced attention span and reduced manual dexterity. Acute neurotic effects can include anaesthesia, euphoria, abusive behaviour, vertigo, and limb numbness. Prolonged contact with material may irritate or burn skin and eyes. Repeated skin exposure may produce defatting dermatitis with drying and cracking. The irritant effects are lowered as the boiling range of the solvent increases. People with pre-existing skin diseases should avoid exposure. Pulmonary aspiration of white spirit can cause fatal chemical pneumonitis. May be synergistic with other solvents[79].

C.97. Other Chemicals. The other components of SR51 were considered to pose less of a hazard and have not been considered further in any of the expert's reports.

State of Australian Knowledge: Australian Workplace Exposure Standards

C.98. The Australian state of knowledge through time for the various components of SR51 desealant, as indicated by the Australian Exposure Standards, include the following:

Table C14: Exposure Standards Through Time of SR51/A Components[80]

Name	Date	TWA		STEL		Comments
		ppm	mg/m^3	ppm	mg/m^3	
Petroleum Solvent	1978					
	1983-4					
	1988	400	1600			
	1991					
	1995					
Thiophenol	1978	0.5	2			Tentative
	1983-4	0.5	2			
	1988	0.5	2			
	1991	0.5	2.3			
	1995	0.5	2.3			
Dimethyl Acetamide	1978	10	35			Skin
	1983-4	10	35	15	50	
	1988	10	35			Skin notice
	1991	10	35			Skin notice
	1995	10	36			Skin notice
Triethyl Phosphate	1978					

78 AMB.0083.006, Paul D and Hanhela P, Evaluation of Treatment and Disposal Procedures for waste Desealant Solutions from F-111C Deseal/Reseal Programme, AMRL Report MRL-R-655, 1979.

79 IOI.0052.040, SIMTARS, Non-spray sealed fuel tanks desk-top audit; 02 May 00 at page 39.

80 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.

	1983-4					
	1988					
	1991					
	1995					

Health Hazard of SR51 Residues

C.99. In addition to the health hazard associated with virgin SR51 desealant, the potential hazard of the wastes generated during the desealing program also need to be addressed. The reaction of thiophenol with polysulphide sealant would be expected to lead to the formation of disulphide breakdown products of unknown toxicity, however, it has been reported that organic disulphides, in general, present low health risks[81]. This position is supported by the data reported in the MSDS of diphenyl disulphide, the oxidation product of thiophenol. It is expected that SR51 wastes from the desealing operation are likely to pose a lesser health hazard than unused SR51 due to reduced thiophenol levels. However as the more highly concentrated SR51A is understood to have been added periodically to the bulk SR51 tank to replenish the thiophenol consumed the precise level of thiophenol in the waste solution at the completion of each desealing operation is unertain.

C.100. The levels of thiophenol in waste SR51 are expected to have decreased upon usage and further during storage. Paul and Hanhela reported that in laboratory experiments, the level of mercaptan sulphur (a measure of thiophenol) decreased from 2.95 % in unused MRL-51 (an AMRL formulation of SR51) to 1.61% in used, untreated MRL-51[82]. This level progressively decreased upon storage to 0.61% after 19 days, 0.35% after 23 days and finally 0.03% after 26 days. Paul and Hanhela concluded that the waste desealant undergoes an autoxidation process which increases in rate with time. It is therefore expected that the toxicity (as measured by thiophenol content) of SR51 wastes which had been allowed to stand for several weeks prior to disposal by incineration would have been significantly decreased.

C.101. It is considered that the health hazard associated with solid sealant removed from the fuel tanks with the hydro-blaster would be largely related to the presence of residual SR51.

C.102. It should be recognized that the odour threshold for detection of thiophenol is 0.0003 ppm, which is well below the workplace exposure standard. Thus the familiar stench of thiophenol will be associated with wastes in which only traces of thiophenol remain.

Exposure Assessment

C.103. Human exposure to SR51 components and emission may occur during removal from F-111 fuselage tanks to its disposal by incineration. The major sources of potential exposure were considered by Miller[83] to be largely limited to:

a. spillage within rag hangar;
b. desealing and cleaning of fuel tanks;
c. drainage and storage in overflow dam;
d. storage of drums;
e. handling of SR51 formulations and waste solutions;
f. collection and handling of urea-formaldehyde foam ‘blocks’;
g. combustion of SR51 wastes in two stage furnace or burner; and
h. downwind exposure to emissions.

C.104. For assessment purposes, exposures to levels that may cause harm rather than simply short-term nuisance (e.g. odours) can be considered[84] in terms of:

a. inside the rag hangar;

[81] AMB.0083.006, Paul D and Hanhela P, Evaluation of Treatment and Disposal Procedures for waste Desealant Solutions from F-111C Deseal/Reseal Programme, AMRL Report MRL-R-655, 1979 at page 9.
[82] AMB.0083.006, Paul D and Hanhela P, Evaluation of Treatment and Disposal Procedures for waste Desealant Solutions from F-111C Deseal/Reseal Programme, AMRL Report MRL-R-655, 1979.
[83] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 9.
[84] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 9.

b. inside the fuel tank after rinsing with alkaline wash;
c. outdoors – near open drains or the open dam;
d. handling of drums, spillage or urea-formaldehyde sponge 'tec' blocks;
e. operation and maintenance of the waste incinerator; and
f. combustion of SR51 wastes and downwind emissions of sulphur dioxide.

C.105. The potential routes of uptake of SR51 components relate to inhalation and dermal or skin contact during the handling of liquids. The dominant pathway to exposure to SR51 components is likely to be inhalation of vapours (thiophenol or aromatic hydrocarbons) and sulfur dioxide gas from combustion of sulfur-containing wastes. Limited dermal absorption is expected in cases of direct contact with solutions or liquids containing thiophenol or aromatic hydrocarbons (C_9 to C_{11}) rather than from airborne vapours[85].

Predicted Workplace Levels

C.106. Concentrations in Rag Hangar. Connell and Miller have estimated the airborne concentrations of SR51 components in the Rag Hangar during the desealing of the fuel tanks with SR51[86]. The source of the SR51 exposure is from vapour losses from the tanks and any leaks or spills. The following assumptions were made:

a. Closed systems cleaning of fuel tank using deseal rig and 3200 litres of SR51.
b. Aircraft located in canvas hangar known as the 'Rag Hangar' (≈ 4000 m^3 volume).
c. The desealing fluid is circulated, through the sprinkler system in the tanks, the hoses and the deseal rig, for 48 hours.
d. Steady state is reached and a well-mixed room model is applicable.
e. One air change per hour.

C.107. The following calculations are made assuming different amounts of vapour loss of 0.01%, 0.1% and 1%.

Table C15: Estimation of Airborne Concentrations of SR51 Components[87]

SR51 Substances	**Airborne Concentrations (mg/m^3)**			
Vapour Losses	**0.01%**	**0.1%**	**0.2%**	**1%**
Thiophenol (10%)	0.14	1.4	2.8	14
Naphtha (80%)	1.12	11.2	22.4	112
Triethylphosphate (5%)	0.07	0.7	1.4	7
Dimethylacetamide (5%)	0.07	0.7	1.4	7
Total	**1.4**	**14**	**28**	**140**

C.108. The most critical component, from the above results, is thiophenol (TWA 2.3 mg/m^3). Given the assumptions outlined above, if vapour losses were in excess of 0.2% it is likely that the concentrations of thiophenol in the Rag Hangar would have exceeded the Exposure Standard. Accordingly, any personnel present in the Rag Hangar during desealing operations, not wearing suitable breathing protection, may have been overexposed to this toxicant. A 0.2% vapour loss equates to evaporation of 6.4 litres of SR51 over a 48 hour period through SR51 vapour leaks and liquid spillages. A major spillage on a hot day could conceivably have resulted in the volatilisation of a larger volume of thiophenol resulting in significant overexposure.

C.109. Concentrations in Fuel Tank. A second scenario examined by Connell and Miller considers the exposure of personnel who entered the fuel tanks during the desealing operation[88]. The source of the SR51 exposure is from residues remaining in the tanks after the alkaline rinse. The following assumptions were made:

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85 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 9.
86 EXP.0011.001,Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks 25 Jan 01 at pages 109-110 and Miller G, Toxicological Assessment of SR51 Waste Disposal – RAAF Amberley; 23 Feb 01 at page 10.
87 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks 25 Jan 01 at page 109.
88 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 110.

a. Fuel tank has been cleaned with ED 500 rinse solutions.
b. Residual rinse solutions are contaminated with SR51.
c. The desealing fluid is circulated through the sprinkler system in the tanks, hoses and deseal rig for 48 hours.
d. Ventilation of the fuel tank is negligible.
e. If the rinse water is saturated with thiophenol (solubility 836 mg/L at 25^{o}C), the equilibrium concentration of thiophenol vapour in a tank under these circumstances can be calculated to be 292 mg/m^3 or 65 ppm (TWA 2.3 mg/m^3 or 0.5 ppm) [89]. This suggests the possibility of significant over exposure for unprotected personnel entering the fuel tanks.
f. The level of thiophenol vapour would be even higher if a thiophenol liquid phase was present. The work procedures suggest that waste rinse waters may contain three (3) per cent of thiophenol. At such excess concentrations, the atmosphere inside the tank would contain much higher levels of thiophenol due to evaporation from the free liquid. The saturation concentration of thiophenol in the headspace above any thiophenol liquid phase can be calculated to be 2 632 ppm (12 475 mg/m^3) [90]. Thus, under these circumstances the potential for over-exposure to thiophenol is greater.

C.110. Outdoor Exposures – Near Open Drains and Dam. Equilibrium concentrations of airborne thiophenol generally would not be attained in an open system as headspace vapours would be dispersed by air movement resulting in much lower vapour concentrations. However, based on model calculations for worst case climatic conditions for a dam or surface drain area of 100 m^2, the downwind (20 meters) concentration of thiophenol was estimated to be up to 4.3 mg/m^3, approximately two times the workplace exposure level (TWA 2.3 mg/m^3). Where free SR51 liquid is evaporating directly from a water surface, higher thiophenol vapour levels could be achieved[91].

C.111. Handling of Drums, Spillage and Contaminated Material – Dermal Exposure. Skin absorption of thiophenol has the potential to result in a significant dose depending upon the duration of exposure event and whether contact is direct (liquid) or via vapour. However, there is a general lack of data on skin absorption rates for thiophenol vapour and liquid and a reference dose (RfD) is also unavailable. However, an approximate reference dose was estimated to be 0.38 mg/kg/day based on the inhalation Exposure Standard of 2.3 mg/m^3 for an eight hour working day[92]. Furthermore, if the skin absorption rate of thiophenol is assumed to be similar to phenol then dermal doses can be calculated for various scenarios[93].

C.112. While intermittent skin contact with the liquid has the potential to absorb a larger dose than skin exposure to the vapour, it was considered that potential liquid contact with thiophenol wastes would be brief and intermittent, especially given the strongly objectionable nature of thiophenol and its skin irritant properties[94]. However, intermittent contact of the hand and forearm with liquid thiophenol can produce daily doses in the range of tens of milligrams per kilogram of body weight per day[95]. Thus direct skin contact with SR51 wastes is likely to result in significant skin absorption of aromatic hydrocarbons.

C.113. There was potential for dermal exposure to liquid thiophenol and aromatic hydrocarbons present during the clean-up of SR51 spillage in the hangar with 'tec blocks' and in skimming surface wastes of SR51 from the dam with the foam blocks. If the blocks were handled with unprotected hands considerable dermal absorption of thiophenol may have occurred.

C.114. Exposure to headspace vapour (292 mg/m^3) above rinse-water saturated with thiophenol may result in a dose of 1.5 mg/kg over a one (1) hour period if the entire body surface is taken to be

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89 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 10.
90 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 110.
91 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at pages 11-12.
92 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 15.
93 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at pages 12 – 16.
94 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 12.
95 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 14.

unprotected, and 0.16 mg/kg for exposure of the hands and arms only. These values compare with the estimate reference dose of 0.38 mg/kg/day. Overall, dermal exposure to the liquid or vapour has the potential to cause clinical effects for short-term exposures. These can range from skin irritation to systemic effects[96].

C.115. Operation and Maintenance of Incinerator. The various tasks carried out by the incinerator operator have been reported as including: general maintenance of incinerator; the clearing of blocked waste feed lines; transportation of drums of SR51 wastes to the incinerator; pumping of wastes from drums into header tanks for feeding into the incinerator; and collection of 'tec blocks' from the dam and rag hangar and their subsequent disposal[97]. It was claimed that all of these activities led to splashing or spraying of the operator with SR51 wastes with repeated exposure of the hands and arms to liquid waste. In the absence of suitable protection for the hands and arms (as occurred in the early stages of the incineration program[98]) considerable skin exposure to the SR51 wastes could have occurred. Ironically, when protective nitrile gloves were eventually issued and worn, it may on occasions have exacerbated the problem as it was claimed that on occasion waste desealant would run down into the glove[99]. In that event, not only would the glove have ensured continuous contact of waste with skin but the absorption rate of the thiophenol and aromatic solvents would most likely have been enhanced by the higher skin temperature inside the glove.

C.116. It is considered that the dermal absorption of thiophenol and aromatic hydrocarbons as a result of the above exposures was potentially significant, particularly when coupled with potential inhalation exposure. However, the inadequate information available for thiophenol together with uncertainty in the level of thiophenol in waste SR51 prevents estimates of dose for various exposure scenarios.

C.117. Incineration Emissions. Combustion trials were undertaken by AMRL which involved sampling and measurement of combustion emissions[100]. Sulphur dioxide levels generated by burning of waste SR51 in a two stage burner were modelled using Ausplume to simulate 'worst case' ground level concentrations of sulphur dioxide[101]. It was concluded that incineration of the SR51 wastes (liquid and solid residues) is likely to have produced sulfur dioxide at levels many times below the Exposure Standards[102].

Simulated Exposure Concentrations

C.118. The following table details the airborne exposure scenarios compared with the workplace exposure standards and effect levels.

Table C16: Airborne Exposure Scenarios Compared to Exposure Standards[103]

Chem	Exposure Levels (mg/m^3)	Haz Index	TWA (mg/m^3)	Scenarios	Effect Levels
THIOPHEN-OL	1.4	0.6	2.3	Hangar – low ventilation, low vapour loss	Skin irritant
	14	6.0		Hangar – low ventilation, high vapour loss	Severe dermatitis, headaches and dizziness
	292	127		Inside tank – saturated rinse water headspace concentration	4hr-LC_{50} 148 mg/m^3 (rat) 125 mg/m^3 (mouse)

96 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 14.
97 Wit.0300.00, Raymond John Webster, Witness Statement.
98 Wit.0300.00, Raymond John Webster, Witness Statement, paragraph 27(xvii).
99 Wit.0300.00, Raymond John Webster, Witness Statement, paragraph 27(xix).
100 AMB.0083.006, Paul D and Hanhela P, Evaluation of Treatment and Disposal Procedures for Waste Desealant Solutions From F-111C Deseal/Reseal Programme, AMRL Report MRL-R-655, 1979.
101 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 12.
102 EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 17.
103 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 28 at page 137.

Estimated Significance

C.119. 'Worst case' potential exposures were likely to involve direct exposure to vapours with poor atmospheric dispersion, and direct contact with SR51 liquids[104].

C.120. The use of SR51/SR51A as chemical desealants during the First DR Program may have resulted in exposure of personnel to thiophenol at levels in excess of the Exposure Standards. There is an extremely high risk of over-exposure of personnel who might have fully or partially entered tanks containing SR51 or rinse-waters saturated with thiophenol without appropriate breathing protection. Personnel undertaking activities in the Rag Hangar during deseal operations may have been exposed to excessive levels depending on indeterminable variables including the spillage rate, vapour loss and extent of ventilation. The uncertainty factor for dermal exposure is considerable due to variable assumptions (for example duration and exposed skin area) and the lack of data on the skin absorption rate for thiophenol and the levels of thiophenol in the wastes. It is unlikely that diluted air concentrations of thiophenol (for example, 1–4 mg/m^3) would cause significant dermal exposure[105]. However, exposure to liquid SR51 or to high headspace concentrations of thiophenol potentially might have resulted in excessive dermal absorption and a high overall body burden when coupled with any concomitant inhalation exposure.

C.121. Miller concluded that there is considerable uncertainty about the adverse effects of repeated exposures to thiophenol for short periods. At least some degree of irritation would be expected but systemic effects are a longer-term risk[106]

PR-148 ADHESION PROMOTER

Introduction

C.122. General. This section will look at the use of PR-148, an adhesion promoter used in the First, Second and Wings DR Programs. PR-148 was applied by wiping with a cheesecloth dampened with the product in order to prepare the surface for the application of the polysulphide sealant.

C.123. Composition The ingredients and workplace exposure levels contained on the MSDS for PR-148, includes:

Table C17: Exposure Standards for PR-148 Ingredients[107]

%	Ingredient	CAS number	TWA/STEL
30-60%	Toluene	108-88-3	100 ppm/150 ppm
10-30%	Light aliphatic naphtha	64742-64-9	100 ppm
10-30%	Ethyl acetate	141-78-6	400 ppm
10-30%	Methyl ethyl ketone	78-93-3	150 ppm/300 ppm
10-30%	Isopropanol	67-63-0	400 ppm/500 ppm
1-10%	Tetraoctyl Titanate as titanium(iv) 2-ethylhexoxide	1070-10-6	not available

Note: The first five ingredients are solvents, which are also the components of the Mil-C-38736 Type I and II Solvent Cleaner (Mil-Spec), discussed previously.

Health Hazards

C.124. The health hazards of toluene, aliphatic hydrocarbons, ethyl acetate, methyl ethyl ketone, and isopropanol have been discussed earlier (see Mil-C-38736).

C.125. Tetraoctyl Titanate. Titanium and several of its compounds (salicylate, oxides tannate) exhibit extremely low toxicity and have been used in the treatment of skin disorders. Organic titanates have caused non-specific irritation of the upper respiratory tract, eye damage and local irritation of the skin. In cases of severe exposure, CNS depression may occur. However, at the low concentration in

[104] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 17.
[105] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 16.
[106] EXP.0011.001, Miller G, Toxicological Assessment of SR51 Waste Disposal - RAAF Amberley; 23 Feb 01 at page 17.
[107] AMB.0108.301, SIMTARS, OH92433F14 - Spray sealed fuel tanks desk-top audit, 07 Jul 00 at page 33.

the product (1-10%) these effects should be minimal and would be difficult to separate from exposure to toluene or light aliphatic naphtha.

State of Australian Knowledge: Exposure Standards

C.126. The Australian state of knowledge through time for the various components of PR-148 Adhesion Promoter, as indicated by the Australian Exposure Standards, include the following:

Table C18: Exposure Standards Through Time for PR-148 Components[108]

Name	Date	TWA		STEL		Comments
		ppm	mg/m^3	ppm	mg/m^3	
Toluene	1978	100	380			
	1983-4	100	375	150	560	
	1988	100	375			Skin notice
	1991	100	377	150	565	
	1995	100	377	150	565	Review notice skin absorption
MEK	1978	200	590			
	1983-4	200	590	300	885	
	1988	150	445			
	1991	150	445	300	890	
	1995	150	445	300	890	
Ethyl Acetate	1978	400	1400			
	1983-4	400	1400			
	1988	400	1400			
	1991	400	1440			
	1995	400	1440			Changed to 200 ppm (720 mg/m^3)
Isopropanol	1978	400	980			
	1983-4	400	980	500	1225	
	1988	400	980			Skin notice
	1991	400	983	500	1230	
	1995	400	983	500	1230	Review notice - sensory irritation
Naphtha	1978					
	1983-4					
	1988	400	1600			
	1991					
	1995	100*				
Tectraoctyl Titanate	1978					
	1983-4					
	1988					
	1991					
	1995					

Source: SIMTARS[109]

Workplace Exposure

C.127. Calculations were carried out based on model studies to estimate the potential PR-148 solvent vapour levels in the workplace during the wing and fuselage tank DR operations. In addition, a monitoring program was undertaken in a test chamber simulating an A2 fuselage tank to establish potential exposures to PR-148 solvent vapours during fuselage tank DR operations.

Estimate of Workplace Exposure during Wing Program.

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108 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.

109 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at page 33.

C.128. Calculations were conducted of the potential concentration of each of the volatile components present in the PR-148 formulation during the Wing DR Program[110]. The calculations were carried out, for the atmospheric environment in the immediate vicinity of the wing in the hangar, under various conditions of air mixing, ventilation and emission rates. The predicted air concentrations from the model study (see table below) suggest that there was unlikely to have been any overexposure to the solvents in PR-148 under the assumed conditions. The component of greatest concern in PR-148 is toluene. In the worst case scenario, the TWA for toluene exceeds the exposure standard by less than a factor of two. This worst case scenario assumes an emission rate of 500 g per hour of toluene corresponding to an approximate usage rate of 1 kg per hour of PR-148.

Table C19: Predicted Air Concentrations (mg/m^3) During Application of PR-148 During the Wing DR Program[111]

Chemical	**Air Mixing Ratio (K)**	**Emission Rate (G) (g/hr)[1]**	**Predicted Air Concentrations (mg/m^3)**			
Air Exchange Rate (No. per hour)			**1**	**5**	**10**	**20**
Toluene (30-60%) (TWA = 380 mg/m^3)	1	100	12.5	2.5	1.25	0.625
	0.5	100	25	5	2.5	1.25
	0.1	100	125	25	12.5	6.25
	1	500	62.5	12.5	6.25	3
	0.5	500	125	25	12.5	6
	0.1	500	**625**	125	62.5	30
All (10-30%) Naphtha (TWA = 790 mg/m^3) Ethylacetate (TWA 1 440 mg/m^3) MEK (TWA = 445 mg/m^3) Isopropanol (TWA = 983 mg/m^3)	1	200	25	5	2.5	1.25
	0.5	200	50	10	5	2.5
	0.1	200	250	50	25	12.5
	1	400	50	10	5	2.5
	0.5	400	100	20	10	5
	0.1	400	**500**	100	50	25

C.129. While the concentrations of the individual components of PR-148 were largely all below their respective TWAs it should be noted that an additive effect may need to be taken into consideration if similar organs are targeted. This would require an evaluation of the results by a qualified toxicologist.

C.130. Significance. RAAF personnel physically working during the Wing DR Program are generally unlikely to have suffered inhalation overexposure to components of PR-148 while applying the product. Only in cases of high usage of PR-148 and poor air mixing were exposure levels calculated to approach the workplace exposure limit for toluene. Under these circumstances the additive effect of exposure to the different solvents may have resulted in a combined overexposure. With the proper use of protective breathing apparatus the risk of inhalation exposure would have been negligible. Personnel working in the hangar away from the wings are most unlikely to have suffered overexposure to solvent vapours from PR-148.

C.131. The possible effects to RAAF personnel of inhalation exposure to PR-148 solvents are summarised in the table below.

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110 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 at page 119.

111 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 at page 119.

TableC20: Predicted Effects of Using PR-148[112]

Chem	Exposure Levels (mg/m^3)	Haz Index	TWA (mg/m^3)	STEL (mg/m^3)	Scenarios	Effect Levels
MEK	25-1 250	0.06-2.8	445	890	Cleaner and primer (PR-148) High to low ventilation	295 mg/m^3 slight irritation to nose and throat 590 mg/m^3 mild irritation to eyes interactions with other solvents ≈900-1 800 mg/m^3 low grade intoxication
Toluene	12.5-625	0.03-1.66	377	565	Primer – low ventilation Inside tank	Eye and respiratory irritation 377 mg/m^3 headache, dizziness Lassitude, nausea, sensory effects Odour perception

Estimate of Workplace Exposure during Fuselage Tank DR Programs

C.132. Calculations of the potential concentration of each of the volatile components present in the PR-148 formulation during the fuselage tank DR programs were determined[113]. The calculations were carried out for the atmosphere inside the fuel tanks assuming no mechanical ventilation with only poor natural ventilation. Calculations were also made of the concentrations of the PR-148 components in the hangar proper assuming poor hangar ventilation (1 air change per hour natural ventilation) or with mechanical ventilation (10 air changes per hour). The predicated air concentrations from the model study are reported in the table below. The figures suggest that it is unlikely that excessive inhalation exposure occurred to the solvents in PR-148 in the main hangar with levels considerably below the exposure standards. However, even with the modest emission rates assumed, the levels of toluene vapours inside the fuel tank were calculated to be at least 12 times the exposure standard (TWA) of 380 mg/m^3. Similarly, the levels of the other volatile components were calculated to be significantly above their respective exposure standards. At greater solvent emission rates, the vapour concentrations inside the tank would be expected to be even higher.

C.133. Importantly, the levels of volatile solvent vapours inside the tank would be considerably lower under a scenario of forced ventilation.

Table C21: Ventilation

Chemical	**Emission Rate (G) (g/hr)[1]**	**Predicted Air Concentrations (mg/m^3)**			
		Fuel Tanks		**Inside Hangar**	
Ventilation Rates		**5 m^3/h**	**10 m^3/h**	**1 air change/h**	**10 air changes/h**
Component in PR-148					
Toluene	50	10 000	5 000	6	0.6
Naphtha, Ethylacetate, MEK, and Isopropanol	20	4 000	2 000	2.5	1.25

C.134. Significance. If PR-148 were employed inside the fuselage tanks without using mechanical ventilation, RAAF personnel potentially could have been exposed to very high concentrations of airborne solvents from the adhesion promoter. If adequate breathing protection was not worn during

112 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 28 at page 137.

113 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 121.

the application of the adhesion promoter the potential is high that inhalation overexposure occurred. In contrast it is most unlikely that personnel working in the hangar would have been exposed to unsafe levels of solvent vapours.

Monitoring of Workplace Exposure during Simulated Fuselage Tank DR Programs

C.135. The potential exposures to solvent vapours was established by SIMTARS during the application of PR-148 to test pieces inside an unventilated test chamber with a volume similar to that of an A2 fuselage tank[114]. This monitoring program was undertaken to simulate worst- case exposure inside a fuel tank.

C.136. SIMTARS found that the average levels of solvent vapours measured inside the test chamber during the application of PR-148 were in excess of the individual TWA exposure standards for MEK and for toluene (by 75% and 40% respectively). While the measured levels of isopropanol, naphtha and ethyl acetate were below the respective TWA exposure limits, an additive effect may need to be considered for all the solvents. It was concluded that "*the material may present a significant health risk by inhalation during application in an area without ventilation and personnel should utilize respiratory protection*" [115]. It was also established that the levels of solvent vapours in the test chamber rapidly fell away after application of PR-148 ceased. In addition, SIMTARS found that "*levels of contaminants measured at the test chamber access during the application of PR-148 were below the exposure standards and therefore indicate that this material does not present a significant health risk by inhalation at the access*".

C.137. It is noteworthy that the reported levels of solvent vapours in the SIMTARS monitoring study were significantly lower than those predicted by the model calculations discussed earlier. The difference was difficult to reconcile given the relatively large usage rate of PR-148 reported for the SIMTARS study (500 millilitres over 30 minutes).

Dermal Absorption

C.138. The following table reported by Connell and Miller[116] presents the estimated skin absorption doses and effect levels for toluene in PR-148 compared with reference doses (US-EPS) and effect levels. Exposure of skin to toluene vapour is not expected to pose a significant health hazard alone; the hazard quotient for the scenario of intermittent contact to the entire skin was calculated to be 0.1. In contrast, skin exposure to liquid PR-148 could result in significant absorption of toluene depending on the frequency and extent of dermal contact. Application of PR-148 by damp rag without the use of protective gloves could have led to a significant dermal dose of toluene. The combination of dermal and inhalation exposure could have resulted in an excessive total body burden of toluene.

Table C22: Estimated Skin Absorption Doses and Effect Levels[117] for Priority DR Chemicals Compared with Reference Doses (US-EPA)

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m^3)	Scenario	Effect Levels
Toluene – vapour	0.02	0.1	0.2	0.4	Entire skin scenario, intermittent contact	No significant effects expected (possible neurotoxic effects)

[114] SIMTARS OH92683F3, F-111 fuel tanks deseal/reseal – laboratory simulation of PR-148; 10 May 01.
[115] SIMTARS OH92683F3, F-111 fuel tanks deseal/reseal – laboratory simulation of PR-148; 10 May 01 at page 4.
[116] EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at Table 29.
[117] EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 table 29 at page 139.

Toluene-- Liquid	107	535	0.2		Hand and forearm intermittent contact	Possible changes in liver and kidney weights (animal studies) (NOAEL: 223 mg/kg-day)

MMS-425

Introduction

C.139. General. This section will consider the use of MMS-425 primer employed from 1996 during the spray seal program. This primer is employed as an adhesion promoter prior to the application of the PR-2911 spray sealant and comprises a two-pack system that is mixed prior to spray application.

C.140. Composition. The full compositional data for MMS-425 primer are as follows:

Table C23: Composition of MMS-425[118]

%	Ingredient	CAS Number	TWA/STEL
Part A, Base			
10-30%	Bisphenol A/Epichlorohydrin resin	25068-38-6	0.2 ppm/2 ppm
10-30%	Strontium Chromate	7789-06-2	0.05 mg/m^3
10-30%	*n*-Butyl acetate	123-86-4	150 ppm/200 ppm
10-30%	Methyl ethyl ketone	78-93-3	150 ppm/300 ppm
5-10%	Toluene	108-88-3	100 ppm/150 ppm
Part B, Curing Agent			
30-60%	Isopropyl alcohol	67-63-0	400 ppm
30-60%	Toluene	108-88-3	100 ppm/150 ppm
30-60%	Methyl ethyl ketone	78-93-3	150 ppm/300 ppm
1-10%	Aromatic Amine as 2,4,6-tri (dimethylaminomethyl)-phenol	90-72-2	na
<10%	Aliphatic Amine	na	na

Health Hazards

C.141. The major health hazards are considered to be associated with the exposure to the volatile solvents, isopropyl alcohol, toluene, MEK and *n*-butyl acetate together with exposure to strontium chromate present as airborne particulates.

C.142. Bisphenol A/Epichlorohydrin Resin. Dermal exposure may result in severe skin irritation, contact dermatitis or burns. Allergic contact dermatitis occurs in a significant number of occupational exposures. Eczema, urticaria and photo dermatitis have been reported following dermal exposures. Inhalation of fumes from curing epoxy resins may result in coughing and bronchospasm persisting for several days. Inhalation may result in CNS depression. Epichlorohydrin ingestion may result in cyanosis, muscular relaxation or paralysis, tremor, seizures, and respiratory arrest. Once the resin has cured the material does not represent a significant health hazard[119].

C.143. Strontium Chromate Pigment. This pigment contains hexavalent chromium (Cr VI). Cr VI compounds have been implicated as being responsible for such effects as ulcerated nasal mucosa, perforated nasal septa, rhinitis, nosebleed, perforated eardrums, pulmonary edema, asthma and kidney damage. More common are conditions such as erosion and discolouration of the teeth, primary irritant dermatitis, sensitization dermatitis, and skin ulceration. Severe corneal injury may result from ocular contact with solid or concentrated solutions of chromic acid and other hexavalent chromium salts. Exposure to certain hexavalent chromium compounds appears to be related to an increased risk of lung cancer. Strontium chromate is considered a human carcinogen by the

[118] AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at page 22 and manufacturer's MSDS.
[119] AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at page 22.

International Agency for Research on Cancer (IARC). Acute exposure to chromates may produce pulmonary oedema, pneumoconiosis, metal fume fever, and bronchial asthma (4-8 hours after exposure)[120].

C.144. n-Butyl Acetate. Toxic potential is small. Irritating and narcotic in high concentrations. n-Butyl acetate is more irritating than sec-and ter-butyl acetates. Butyl acetates may cause conjunctivitis. Workers exposed to greater than 200 ppm for 8 hours developed eye, nose and throat irritation. Vapour concentrations of 300 ppm are objectionable. Mild drying of the skin has been reported. Direct skin contact has a low injury magnitude and such injuries usually heal within one day[121].

C.145. Methyl Ethyl Ketone (MEK). See Methyl Ethyl Ketone (MEK) discussed earlier.

C.146. Other Solvents. For toluene and isopropyl alcohol, see Mil-C-38736 (Mil-Spec) Solvent Cleaner discussed earlier.

State of Australian Knowledge: Exposure Standards

C.147. The Australian state of knowledge through time for the various components of MMS-425 primer, as indicated by the Australian Exposure Standards, include the following:

Table C24: Australian Workplace Exposure Standards Through Time for MMS-425 Components[122]

Name	**Date**	**TWA**		**STEL**		**Comments**
		ppm	**mg/m^3**	**ppm**	**mg/m^3**	
Toluene	1991	100	377	150	565	
	1995	100	377	150	565	Review notice skin absorption
MEK	1991	150	445	300	890	
	1995	150	445	300	890	
n-Butyl Acetate	1991	150	710	200	950	
	1995	150	713	200	950	
Isopropanol	1991	400	983	500	1 230	
	1995	400	983	500	1 230	Review notice - sensory irritation
2,4,6–Tri (dimethylaminomethyl) phenol	1991					
	1995					
Strontium Chromate	1991		0.05			Sensitising agent Water soluble Chromium IV
	1995		0.001			Carcinogen Category 3 (proposed)
Bisphenol A/Epichlorohydrin resin	1991					
	1995	0.2*		2*		

Source: SIMTARS[123].

Workplace Estimates

C.148. Concentrations of Solvents. In order to predict the airborne concentrations of solvents in the fuel tanks the following assumptions are made:

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120 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at page 22.
121 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at pages 22-23.
122 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Jan 01 Table 7 at page 60.
123 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at page 22.

a. The volume of the fuel tank is 5 m^3.
b. The operation has a spray duration of two (2) hours.
c. The amount of MMS-425 primer used was two (2) litres.
d. Ventilation rates are estimated to be between one (natural) and twenty (forced) air exchange per hour.
e. The primer contains 50% solvent (1L).
f. The rate of solvent released from the sprayed primer is 20% or 50% per hour (F value). Different environmental/atmospheric conditions will dictate the rate of solvent release.

Table C25: Predicted Air Concentrations of MMS-425 Components[124]

F Values	**Predicted Air Concentrations (mg/m^3)**			
Ventilation Rates (m^3/hr)	**5**	**10**	**50**	**100**
***n*-butyl acetate** (TWA 713 mg/m^3) or **MEK** (TWA 445 mg/m^3)				
0.2	8 000	4 000	800	400
0.5	20 000	10 000	2 000	1 000
Toluene (TWA 377mg/m^3)				
0.2	4 000	2 000	400	200
0.5	10 000	5 000	1 000	500

C.149. The above table shows that unless forced air ventilation is used extremely high values of the solvents will be experienced inside the fuel tank. It should be noted that airborne concentrations of vapours in the immediate vicinity of the spray area would be expected to be somewhat higher than the average tank values given in the table.

C.150. Concentrations of Strontium Chromate. Calculations of the predicted airborne concentrations of chromate levels were undertaken with the same assumptions outlined above for the calculations of solvent vapour levels. Additionally, an over-spray factor of 10% was applied and the proportion of strontium chromate in solids was set at 20%.

Table C26: Predicted Air Concentrations of Strontium Chromate in Fuel Tanks[125]

	Predicted Air Concentrations (mg/m^3)			
Ventilation Rate (m^3/hr)	**5**	**10**	**50**	**100**
Strontium Chromate (20%)*	200	100	20	2
(10%)*	100	50	10	1

TWA of Strontium Chromate 0.001 mg/m^3.

C.151. Significance. The above estimations of chromate concentrations are <u>extremely high</u>, being 3-5 orders of magnitude greater than the Workplace Exposure Standard. This would constitute a major hazard to workers inside the fuel tanks. Correct protection measures would need to be identified and strictly adhered too. The airborne concentration of strontium chromate will be dependent upon the degree of over-spray of the primer. Factors contributing to over-spray include; excessive stand-off distances, and high linear ambient air speed (due to ventilation) while spraying. Where a poor ventilation configuration is employed, the degree of over-spray could, ironically, be expected to increase with the ventilation rate.

C.152. Concentrations of Solvents and Chromate in the Hangar. Predicted airborne concentrations of the primer inside the hangar are assumed to involve a continuous emission from the fuel tank outlet(s) or venting. Estimates of air concentrations during primer spraying are based upon earlier emission rates for this primer.

124 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 115.
125 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 116.

Table C27: Estimated Concentrations inside Hangar[126]

Chemicals	Estimated Air Concentration (mg/m^3)
***n*-butyl acetate/MEK** (TWA 713 mg/m^3)	≤ 5
Toluene (TWA 445 mg/m^3)	≤ 2.5
Strontium chromate (TWA 0.001 mg/m^3)	≤ 0.125

C.153. Significance. Based on models, the potential concentrations of solvents inside the hangar were calculated to be well below the limit of the Workplace Exposure Standards. The strontium chromate levels, however, would still be extremely high (greater than two orders of magnitude).

C.154. The following table compares model airborne exposure scenarios compared with the workplace exposure standards and effect levels.

126 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 116 and page 99 - see also AMB.0020.082 Armstrong Laboratory, Appendix B to Industrial Hygiene IOI.0013.368, Evaluation of F-111 Fuel Tank Sealant Process (the Armstrong Report); 1 Dec 1992 from page 19.

Table C28: Estimated Effect Levels Compared to Exposure Standard[127]

Chemical	Exposure Levels (mg/m^3)	Haz Index	TWA (mg/m^3)	STEL (mg/m^3)	Scenarios	Effect Levels
MEK	5 000-10 000	11.2-22.4			Exposure to MMS-425 primer: Inside tank – low ventilation	≈9000 mg/m3 - irritating to nose and eyes interactions with other solvents
Toluene	2 000-10 000	5.3-22.5	377	565	Exposure to MMS-425 primer: Inside tank – low ventilation	Palpitation, extreme weakness, pronounced loss of co-ordination and impairment of reaction time
	<2.5	<0.006			Hangar – one air exchange per hour	No effects anticipated
Strontium chromate	50-200	1 000-4 000	0.001		Primer MMS-425 Inside tank – low ventilation	Irritant and Allergic Contact Dermatitis, Skin Ulceration, Rhinitis To Perforation Of Nasal Septa
	≤0.125	≤2.5			Hangar – one air exchange Air exchange may be higher Mixing may increase level in air	Skin and possible nasal irritations Cr^{VI} compounds: increased risk of lung cancer

Simulated Workplace Environment

C.155. Test Environment. SIMTARS measured the concentrations of airborne toxicants during the mixing, spraying and curing of the MMS-425 primer[128]. The primer was mixed in a naturally ventilated area with monitoring performed adjacent to the bench where the mixing task was being performed. The primer was subsequently sprayed onto test pieces in a non-ventilated test chamber of a similar volume to the A2 fuselage tank, with samples collected in the test chamber and adjacent to the chamber access.

C.156. Test Results. The level of contaminants measured for all agents assessed during mixing was below the Exposure Standard. SIMTARS concluded that mixing does not present a significant health risk in isolation[129]. The level of contaminants at the test chamber access during spraying was below the exposure standards, however, inside the spray chamber the levels of contaminants were significantly in excess of the Exposure Standards. The health risk is thus high. The level of contaminants inside the test chamber, measured during the curing of the primer, varied considerably from test to test. However, isopropyl alcohol and chromate levels were all below their respective exposure standards. Toluene, *n*-butyl acetate and MEK were found to be in excess of their exposure limits. By the second hour of curing the levels of all the contaminants had generally fallen to below their Exposure Standards.

Air Monitoring in a US Workplace Environment (The Armstrong Report[130])

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127 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 28 at page 137.

128 AMB.0130.192, SIMTARS OH92683F1, F-111 fuel tanks deseal/reseal – laboratory simulation; 20 Dec 00.

129 AMB.0130.192, SIMTARS OH92683F1, F-111 fuel tanks deseal/reseal – laboratory simulation; 20 Dec 00 at page 7.

130 AMB.0020.082, Armstrong Laboratory, Industrial Hygiene Evaluation of F-111 Fuel Tank Sealant Process (The Armstrong Report); 01 Dec 1992.

C.157. The Armstrong Laboratory conducted an industrial hygiene evaluation during the application of MMS-425 Primer at McClellan AFB in the US during 1991. Local supply and exhaust ventilation were employed as a dual push-pull system during the application. Breathing zone samples were collected on the personnel spray-applying the primer and additional samples were collected at various locations throughout the hangar and in the mixing area.

C.158. Sample results within tanks. The highest solvent exposures were for isopropyl alcohol and toluene. However, while neither compound's 8-hour TWA exceeded the Exposure Standards, the level of isopropyl alcohol exceeded a worst case STEL by three times. Strontium chromate 8-hour TWA values exceeded the Exposure Standards by as much as 680 times, however, the report questioned the validity of the high chromate values on technical grounds[131].

C.159. Sample results during mixing. All the results of the samples collected on the mixer were below the recommended exposure guidelines.

C.160. Sample results within hangar. Sample collection points within the hangar ranged from near the tank access to 120 feet from the aircraft being sprayed. It was concluded that, with the exception of strontium chromate, no airborne hazard exists outside the fuel tanks. The level of airborne chromate was found to vary with each of the spray surveys undertaken and the location of the sampling point. Levels of chromate measured on the helper near the tank access were found to exceed the exposure limits by over 100 times.

Dermal Exposure Assessment

C.161. Exposure through Use of Inappropriate PPE. The PPE (coveralls) employed during the spray application process were determined to be inappropriate (see section on MEK).

C.162. The following table presents the estimated skin absorption doses and effect levels MMS-425 constituents compared with reference doses (US-EPS)[132]. Exposure of skin to toluene vapour is not expected to pose a significant health hazard alone; the hazard quotient for entire skin scenario intermittent contact was calculated to be 0.1. However, the exposure hazard posed by exposure of skin while wearing inappropriate coveralls is difficult to assess. Not only can coveralls act as bellows but the absorption rate of chemicals by hot skin can be considerably higher than that by cool skin. The final entry in the table below suggests that up to 77 times the reference dose of chromate can be absorbed by dermal exposure to over-spray particulates. This value appears excessively high and requires confirmation.

Table C29: Estimated Skin Absorption Doses Compared with Reference Doses[133]

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m^3)	Scenario	Effect Levels
Toluene - vapour	0.02	0.1	0.2	0.4	Entire skin scenario, intermittent contact	No significant effects expected (possible neurotoxic effects)

131 AMB.0020.082 Armstrong Laboratory, Industrial Hygiene Evaluation of F-111 Fuel Tank Sealant Process (the Armstrong Report); 01 Dec 1992 at page 15.

132 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 29 at page 139.

133 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 29 at page 139.

Toluene liquid	107	535	0.2		Hand and forearm intermittent contact	Possible changes in liver and kidney weights (animal studies) (NOAEL: 223 mg/kg-day)
Strontium chromate	0.457-0.91	39-77	3×10^{-3} (0.003) as CrVI		Epoxy resin solids – inside tank, low ventilation (one-two days exposure/week)	Irritant and allergic contact dermatitis sensitised individuals

C.163. Significance. These estimates suggest that the dermal absorption of toluene vapour is unlikely to be significant. While intermittent contact of the hand and forearm with pure liquid toluene can result in an average daily dose over 500 times the reference level, the extent of dermal absorption of toluene from MMS-425 primer which comprises approximately 5% by volume of toluene is difficult to estimate. The potential dermal dose of chromate resulting from exposure of unprotected skin to over spray particulate is of concern.

Significance of Results of Workplace Monitoring and Model Estimates

C.164. Overall, there is broad agreement between the measured airborne concentrations of MMS-425 components from workplace monitoring and the levels calculated through mathematical modelling, which lends credibility to the model work. The greatest risk is clearly to personnel spraying the primer in the fuel tanks. Very high levels of solvent vapours will accumulate in the confined space of the fuel tank in the absence of any mechanical ventilation. However, with appropriate ventilation it is expected that the solvent vapour levels will fall to near or below the Workplace Exposure Standards. Risk would be mitigated when ventilation is combined with PPE (with a protection factor of 1000). It appears that the greatest risk while applying the primer is inhalation exposure to chromates in the fuel tank. While the risk of dermal exposure to chromate was calculated by Connell and Miller[134] to be potentially significant, it is unclear to this author whether the calculations were based on permeation rates of water-soluble chromates or of strontium chromate which is water-insoluble. Also, given that the airborne chromate results from over spray, it would be expected that the bulk of the chromate would be encapsulated in paint. Accordingly, the calculated dermal exposure risks may be overstated.

[134] EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 Table 29 at page 139.

PR-2911 SPRAYABLE SEALANT

Introduction

C.165. General. This section will consider the use of PR-2911 spray sealant during the fuselage tank Spray Seal Program that commenced in 1996. This product is a two-pack isocyanate-curing polythioether sealant that is applied over existing aged sealant, after priming with MMS-425 adhesion promoter.

C.166. Composition. The full compositional data is as follows:

Table C30: Ingredients of PR-2911[135]

%	Ingredient	CAS number	TWA/STEL
Part A			
>60%	Propylene Glycol Monomethyl ether Acetate (PGMA)	108-65-6	100 ppm
<10%	Diethyltoluenediamine (DETDA)	68479-98-1	0.02 ppm
n/a	Polyether polyol (extended)	70682-83-6	not available
n/a	Silica (dimethyl siloxane treated)	67762-90-7	10 mg/m^3
<1%	Carbon black	1333-86-4	3 mg/m^3*
<1%	Titanium dioxide		10mg/m^3**
Part B			
>60%	Polyurethane prepolymer as polythioether polymer with HMDI	83346-49-0	0.02 mg/m^3
1-3%	Methylene-bis-(4-cyclohexyl isocyanate) (HMDI)	5124-30-1	0.02 mg/m^3
1-20%	Propylene glycol monomethyl ether acetate	108-65-6	100 ppm

Black Part A only.
** White Part A only.

Health Hazards[136]

C.167. Propylene Glycol Monomethyl Ether Acetate (PGMA). At concentrations of about 100 ppm, eye, nasal and throat irritation will be noticed. The first indication of CNS impairment occurs at 1 000 ppm. The acetate generally has a lower vapour pressure than the ether and this would reduce the propensity for toxic effects. The health hazard is generally assessed as being low.

C.168. Diethyltoluenediamine (DETDA). Many amines are potent skin sensitisers and local reactions can include severe dermatitis and urticaria. Amines are also major eye irritants and can cause ophthalmia or permanent blindness. Amines have also been implicated in asthma, gastritis and blood pressure increase. Exposure to this material should be minimised.

C.169. Polyether Polyol (Extended). No significant health hazards have been noted.

C.170. Silica (Dimethyl Siloxane Treated). Low level of toxicity. Some problems if dimethyl siloxane is injected into the body. Amorphous silica is not regarded as a significant health hazard.

C.171. Carbon Black. There are no well-documented health hazards to humans from acute exposure to carbon black. Potential health effects are usually attributed to impurities rather than to the carbon itself. Carbon black may be irritating to the skin and respiratory tract. Chronic exposure to high levels of carbon black can cause an accumulation in the lung with chronic bronchitis and an obstructive-like condition. The summary of major occupational studies on carbon black conclude that it acts like any other nuisance dust in its pure form.

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135 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at pages 14-21.
136 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at pages 14-21.

C.172. Titanium Dioxide. Practically non-toxic.

C.173. Polyurethane Pre-polymer as Polythioether Polymer with HMDI. In the polymerised form this material does not represent a significant health hazard. Free isocyanates have been implicated in respiratory illnesses such as asthma and bronchitis. Individuals can be pulmonary sensitised following exposure to isocyanates. Inhalation, eye and skin contact should be avoided.

C.174. Methylene-bis-(4-cyclohexylisocyanate) (HMDI). This compound is regarded as poisonous and may be fatal if inhaled, swallowed or absorbed through the skin. Direct contact can cause burns to the skin or eyes. In general isocyanates are irritating to the skin, eyes and respiratory tract and are a common cause of allergic sensitisation of the respiratory tract. Sensitive individuals can react to extremely low concentration of isocyanates. This compound has a low vapour pressure and is one of the least hazardous isocyanates.

State of Australian Knowledge: Workplace Exposure Standards

C.175. The Australian state of knowledge through time for the various components of PR-2911, as indicated by the Australian Workplace Exposure Standards, includes the following:

Table C31: Australian Workplace Exposure Standards Through Time for PR-2911 Components[137]

Name	Date	TWA		STEL		Comments
		Ppm	mg/m^3	ppm	mg/m^3	
Diethyltoluenediamine (DETDA)	1991					
	1995	0.02*				
Silica	1991		10*			
	1995		2			
PGMA	1991					
	1995	100*				
Carbon Black	1991		3			
	1995		3			
Polyether polyol	1991					
	1995					
Polyurethane prepolymer	1991					
	1995		0.02*			
HMDI	1991		0.02		0.07	Sensitiser notice
	1995		0.02		0.07	Sensitiser notice

Source: SIMTARS[138]

Estimated Workplace Exposure

C.176. Predicted Concentrations. The following information concerns the predicted concentrations of airborne contaminants inside the fuel tanks and within the hangar. The potential hazards related to the spraying of the PR-2911 sealant are considered to be PGMA, DETDA and the isocyanate, HMDI. Model based calculations were made of the potential airborne concentrations of PGMA and HMDI and the values are tabulated below[139]. To assist the modelling the following assumptions were made:

C.177. 15 litres of white PR-2911 is sprayed over a four (4) hour period followed by 15 litres of black PR-2911 over an additional four (4) hour period.

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137 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge - Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 Table 7 at page 60.

138 AMB.0108.301, SIMTARS, Spray sealed fuel tanks desk-top audit; 07 Jul 00 at pages 14-16.

139 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 117.

C.178. The concentrations of PGMA, DETDA and HMDI are at the maxima of the ranges indicated in the composition table above.

Table C32: Predicted Air Concentrations in Fuel Tanks and Hangar (mg/m^3) [140]

Chemical	**Predicted Air Concentrations (mg/m^3)**			
Ventilation Rate (m^3/hr)	**5**	**10**	**50**	**100**
Fuel Tank				
PGMA (TWA 528 mg/m^3)	3 000	1 500	300	150
HMDI (monomer) (TWA 0.02 mg/m^3)	11	5	1.1	0.55
Inside Hangar	1 air change per hour		10 air changes per hour	
PGMA (TWA 528 mg/m^3)	1.9		0.19	
HMDI (monomer) (TWA 0.02 mg/m^3)	0.007 (<0.01)		<0.001	

C.179. The model calculations suggest that in the absence of mechanical ventilation the concentration of PGMA and HMDI in the tank could exceed the workplace exposure limit. The potential concentration of PGMA at the lowest ventilation rate was calculated to be up to six (6) times the Workplace Exposure Standard. However, at the highest ventilation rate the level of PGMA was calculated to be below the Standard. In the case of HMDI, the concentration was calculated to still exceed the standard by 28 times at the highest ventilation rate. However, the values of HMDI levels are most likely to be significantly overstated. This is due not only to HMDI being one of the least volatile isocyanates commonly employed in coatings technology but also, HMDI would react with the diamine in cross linking reactions, thereby, chemically fixing this component. It appears that allowances for this reactivity were not made in the model. The airborne concentrations of the two components in the hangar were both calculated to be significantly below the Workplace Exposure Standards.

Simulated Workplace Exposures

C.180. Assessment of PR-2911 Mixing and Spraying. The simulation of PR-2911 mixing and spray sealing was conducted by SIMTARS as follows[141].

a. PR-2911 White Part A and Part B were mixed in a bucket on the ground using an electric drill with a paint mixing paddle attached.
b. One kit was used (consisting of 2 one-gallon cans).
c. The area was naturally ventilated.
d. Sprayed four test pieces and sections of wall inside a test chamber approximately the volume of A2 tank.
e. There was no ventilation inside the chamber.

C.181. The measurements of the airborne concentrations of the PGMA, HMDI and DETDA are presented in the table below. The monitoring results show the levels of HMDI and DETDA to be below the limits of detection for the sampling methods and thus below the Workplace Exposure Standard under all conditions. In the trial, the level of PGMA solvent remained below the Standard during mixing (open work area), however, reached levels approximately 16 times the Standard during spraying, where no ventilation was employed in the test chamber. In the absence of ventilation, PGMA levels remained at levels in excess of the Exposure Standard for at least three days after the completion of spraying. The levels inside the chamber did not decrease to what may be considered acceptable risk levels until seven days after application. It is noteworthy that in the absence of

140 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 117.

141 SIMTARS OH92683F4, F-111 fuel tanks deseal/reseal – laboratory simulation of PR-2911; 10 May 01.

ventilation, the levels of airborne PGMA, HMDI and DETDA at the test chamber access were well within acceptable limits.

Table C33: Exposure Measurements by Scenario

Test	**Propylene glycol monomethyl ether acetate (PGMA) (ppm) [number of samples]**	**HMDI *[number of samples]***	**Diethyltoluene-diamine (DETDA) (ppm) [number of samples]**
Mixing: Open work area	3 [2]	< 0.002 [2]	<0.003 [2]
Spraying: Inside chamber	1610 [4]	,0.002 [4]	<0.002 [4]
Curing: Inside chamber during first two hours after spraying	539 [4]	<0.001 [4]	<0.001 [4]
Inside chamber after 1 day	441 [10]	< 0.0001 [2]	<0.001 [10]
Inside chamber after 2 days	278 [4]	Not determined	Not determined
Inside chamber after 3 days	137 [2]	Not determined	Not determined
Inside chamber after 6 days	88 [4]	Not determined	Not determined
Inside chamber after 7 days	43 [4]	Not determined	Not determined
Access during spraying	14 [2]	,0.001 [2]	<0.002
Access after 1 day	3 [1]		
-	100 #	0.005**	0.02 ##

- American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit
- value (TLV)

** American Industrial Hygiene Association (AIHA) Workplace Environmental Exposure Level (WEEL) Guides.

*** Bayer CEL TWA

Air Monitoring in a US Workplace Environment (The Armstrong Report)

C.182. The Armstrong Laboratory conducted an industrial hygiene evaluation during the application of PR-2911 spray sealant at McClellan AFB in the US during 1991[142]. Local supply and exhaust ventilation units were employed as a dual push-pull system during the application. Breathing zone samples were collected on the personnel spray-applying the sealant and additional samples were collected at various locations throughout the hangar, at the tank access and in the sealant mixing area.

C.183. Sample Results within Tanks (on the Sealer). Nine separate readings of isocyanate levels in the tank over 7 spray operations ranged from 0.01 to 2.6 mg/m^3; a tenth reading showed a level of 55.21 mg/m^3. These compare with the TWA workplace exposure limits of 0.02 mg/m^3. The 8-hr TWA readings were somewhat lower with the worst reading of 0.56 mg/m^3 exceeding the exposure standard by 28 times. The level of PGMA inside the tanks varied between 453 and 1 159 mg/m^3, however, the 8-hr TWA readings of PGMA were all below the 8-hr TWA exposure standard of 528 mg/m^3.

C.184. Sample Results during Mixing. All the results of the samples collected on the mixer were below the recommended exposure guidelines. However, due to the extreme sensitising characteristics of isocyanates and the close proximity to the ongoing spray sealing operations the wearing of PPE, including full-face dual cartridge organic-vapour respirators (later amended to full-faced air-supplied respirator in the AAP 292-5 procedures), was recommended for all mixing personnel[143].

142 AMB.0020.082 Armstrong Laboratory, Industrial Hygiene Evaluation of F-111 Fuel Tank Sealant Process (The Armstrong Report); 01 Dec 1992.

143 AMB.0020.082 , Armstrong Laboratory, Industrial Hygiene Evaluation of F-111 Fuel Tank Sealant Process (The Armstrong Report); 01 Dec 1992 at page 15.

C.185. Sample Results within Hangar. Sample collection points within the hangar ranged from near the tank access to 120 feet from the aircraft being sprayed. The levels of DETDA and PGMA were below the recommended exposure limits. Measurements of airborne isocyanate in the hangar were made over six separate spray sealing operations resulting in 23 individual measurements. With the exception of one reading of 0.57 mg/m^3 the levels of HMDI were all below 0.012 mg/m^3. No comment was made in the report regarding the anomalous reading for the location forward of the starboard wing, which was some 50 times higher than the next largest readings in the sample. The 8-hour TWA readings, however, were below the recommended exposure level of 0.02 mg/m^3 for all 23 readings. It was concluded in the report that no airborne hazard (emanating from PR-2911) exists outside the fuel tanks[144].

Significance of Model Calculations and Workplace Monitoring

C.186. The model calculations and contaminant monitoring results indicate the personnel carrying out the spray sealing operations in the tank are at greatest risk. Even with effective ventilation, the levels of toxicants inside the tanks are likely to exceed Workplace Exposure Standards; at reduced ventilation rates the levels of contaminants would be expected to be significantly higher. If positive-pressure air-supplied respirators were correctly worn in the tanks, it is considered unlikely that personnel, carrying out spray sealing operations in the fuel tanks, would have experienced inhalation overexposure to toxicants present in PR-2911.

C.187. It is considered unlikely that personnel carrying out sealant mixing operations or other personnel in the hangar proper would have experienced inhalation overexposure to toxicants present in PR-2911.

C.188. In the absence of ventilation, a health risk remains for personnel entering tanks several days after the completion of spray sealing and the use of respiratory equipment is required.

Dermal Exposure Assessment

C.189. Connell and Miller reported that dermal exposure (in the fuel tanks) to isocyanate at the levels predicted by their modelling could possibly lead to skin sensitisation, nasal effects, and chronic lung function decline[145]. The estimated skin absorption doses for isocyanate, HMDI, compared with reference doses (US-EPA) and effect levels are shown below for the scenario of spray sealing in the fuel tank with poor ventilation.

Table C34: Calculated Effect of Exposure

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m^3)	Scenario	Effect Levels
Isocyanate (HMDI) in PR-2911	0.003-0.018	0.05-0.3	NA	0.06 (HMDI)	Inside tank, low ventilation Spraying of isocyanate containing resins (one to five days a week contact)	Possible nasal effects Possible sensitisation Chronic lung function decline

C.190. Significance. The extent of dermal exposure to isocyanates during the spray sealing process is difficult to assess. If correct PPE had been worn at all times, it is unlikely that personnel would have been overexposed. However, the reports of possible skin contact with spray sealant upon disrobing from the PPE together with suggestions that the coveralls had often torn during the spray seal process

144 AMB.0020.082 , Armstrong Laboratory, Industrial Hygiene Evaluation of F-111 Fuel Tank Sealant Process (The Armstrong Report); 01 Dec 1992 at page 15.

145 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 136.

is of concern. Not only can torn coveralls act as bellows, but also the absorption rate of chemicals by hot skin can be considerably higher than that by cool skin.

PR 1750 POLYSULPHIDE SEALANT

Introduction

C.191. General. PR-1750 is a polysulphide sealant supplied as two parts, a base and a curing agent, which must be mixed prior to application. The curing agent constitutes only a small proportion of the overall formulation. The sealant is available in different classes: Class A sealant can be brush applied while the higher viscosity Class B is applied with a caulking gun.

C.192. Composition of Formulation. The full composition of PR-1750 is as follows:

Table C35: Ingredients of PR-1750[146]

%	Ingredient	CAS number	TWA/STEL
PRC-Desoto PR-1750A½, B½, A2, B2, & B6 Part A* Accelerator (Curing Agent)			
30-60%	Hydrogenated terphenyls	61788-32-7	0.5 ppm
30-60%	Manganese dioxide	1313-13-9	1 mg/m^3
1-10%	Diphenylguanidine	102-06-7	na
1-10%	Carbon black	1333-86-4	3 mg/m^3
1-10%	talc	14807-96-6	2 mg/m^3
PRC-Desoto PR-1750A½, B½, A2, B2, & B6 Part B* Base Compound			
na	Trichloropropane/sodium polysulphide copolymer	68611-50-7	10 mg/m^3
10-30%	Limestone (calcium carbonate)	1317-65-3	10 mg/m^3
1-10%	Titanium dioxide	13463-67-7	10 mg/m^3
10-30%	**METHYL ETHYL KETONE(MEK)****	78-93-3	150/300 ppm
1-10%	Toluene	108-88-3	100/150 ppm

PR-1750 is mixed in a ratio of 1:10 by weight of Part A and Part B
** There is no MEK in PR-1750B2 and B6.

Health Hazards[147]

C.193. Hydrogenated terphenyls. Prolonged contact with hydrogenated terphenyls can cause defatting of the skin. Temporary eye irritation occurs after splashing. Problems with upper respiratory tract irritation and nausea following inhalation after over-heating or aerosol generation of hydrogenated terphenyls have been reported. Studies have shown no skin sensitisation or recognisable adverse health effects except that the mixture was found to act as a primary skin irritant, particularly, when workers were wearing protective clothing and the moistness of the skin was increased.

C.194. Manganese Dioxide. Toxicity is most common following chronic inhalation or ingestion. Two clinical patterns are common: one involving Parkinsonism, and the other pneumonia. Acute exposure resulting in fatal pneumonia has been reported among manganese workers. Metal fume fever has been reported following inhalation exposure to manganese oxide. Neurologic changes are most frequently reported following chronic inhalation of manganese dusts. Effects include a Parkinsonism-like syndrome, muscle weakness, impairment of speech, gait disturbances, tremor, slurred speech, diminished libido and behavioural disturbances. Symptoms may last 1 to 2 months or longer. Manganese psychosis is a transitory syndrome characterised by nervousness, irritability and compulsive behaviour. This is most frequently noted following chronic dust exposure. Patients with manganese-induced Parkinsonism may have impaired intellectual function as assessed by IQ tests. Some studies of manganese exposed workers without clinical evidence of Parkinsonism has suggested poorer motor speed, problems with visual scanning and lack of coordination. The use of neuropsychological tests of motor functions, response speed and memory to assess asymptomatic manganese workers has been proposed.

146 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 21.
147 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at pages 21-23.

C.195. Diphenylguanidine. Low toxicity powder.

C.196. Carbon Black. Discussed earlier (see PR-2911).

C.197. Magnesium Silicate (talc). Chemical name for talc. Used as a filler and pigment and does not generate dust in significant quantity. Pneumoconiosis associated with obstructive and restrictive lung disease following chronic intentional inhalation of talcum powder has been reported. This is not a risk in this application.

C.198. Trichloropropane/sodium polysulphide copolymer. Moderate irritation of the skin, eyes and mucous membranes of the respiratory tract. Vapours of 1,2,3-trichloropropane were objectionable to all subjects exposed at a concentration of 100 ppm because of eye and throat irritation and unpleasant odour.

C.199. Limestone. Practically non-toxic.

C.200. Titanium dioxide. Practically non-toxic.

State of Australian Knowledge: Exposure Standards

C.201. The Australian state of knowledge through time for the various components of PR-1750, as indicated by the Australian Workplace Exposure Standards, includes the following[148].

Table C36: Australian Workplace Exposure Standards Through Time for PR-1750 Components

Name	Date	TWA		STEL		Comments
		Ppm	mg/m^3	ppm	mg/m^3	
Toluene	1978	100	380			
	1983-4	100	375	150	560	
	1988	100	375			Skin notice
	1991	100	377	150	565	
	1995	100	377	150	565	Review notice skin absorption
MEK	1978	200	590			
	1983-4	200	590	300	885	
	1988	150	445			
	1991	150	445	300	890	
	1995	150	445	300	890	
Manganese dioxide	1978					
	1983-4					
	1988					
	1991					
	1995		1*			
Carbon Black	1978		3.5			
	1983-4		3.5		7	
	1988		3			
	1991		3			
	1995		3			
Hyrogenated terphenyls	1978	0.5	5			
	1983-4	0.5	5			
	1988	0.5	5			
	1991	0.5	5			
	1995	0.5	4.9			
Diphenyl guanidine	1978					
	1983-4					
	1988					
	1991					
	1995					
Limestone	1978					
	1983-4				20	
	1988		10			
	1991		10			
	1995		10			
Titanium dioxide	1978					
	1983-4				20	
	1988		10			
	1991		10			
	1995		10			
Trichloropropane/ sodium	1978					

148 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at Table 7 at page 60.

polysulfide copolymer						
	1983-4					
	1988					
	1991					
	1995		10*			

Source: SIMTARS[149]

C.202. The major inhalation hazards with PR-1750 were considered to be airborne toluene and hydrogenated terphenyls[150]. Although the latter is a major component in the Part A curing agent (30-60%), it constitutes a minor component (<6%) in the mixed sealant. Toluene also constitutes less than 10% of the sealant upon mixing. Potential workplace levels of these two contaminants were estimated from model calculations for the Wing DR Program and are reported below.

Estimate of Exposure levels during Wing Tank DR Program

C.203. General. The predicted air concentrations (mg/m^3) of toluene and hydrogenated terphenyls, during the application of PR-1750, for a hangar of 8000 m^3, variable hourly air exchange rates (1 to 20) and poor mixing above and near wing tank fuel, are tabulated below[151]. The model suggests that even in the 'worst case' scenario of poor ventilation and poor mixing of the air in close proximity to the wing, the Exposure Standards are unlikely to be exceeded.

Table C37: Predicted Air Concentrations – Wing Tank Deseal/Reseal

Chemical	**Air Mixing Ratio (K)†**	**Emission Rate (G) (g/hr)‡**	**Predicted Air Concentrations (mg/m^3)**			
Air Exchange Rate (No. per hour)			**1**	**5**	**10**	**20**
Toluene (TWA for toluene is 377 mg/m^3)	1	62.5	8	1.6	0.8	0.4
	0.5	62.5	16	3.2	1.6	0.8
	0.1	62.5	80	16	8	4
Hydrogenated terphenyls¤ (TWA for hydrogenated terphenyls is 0.5 mg/m^3)	1	3.75	0.5	0.1	0.05	0.025
	0.5	3.75	1.0	0.2	0.10	0.05
	0.1	3.75	5.0	1.0	0.5	0.25
Trichloropropane (TWA for trichloropropane is 10 mg/m^3)	1	31.25	4	0.8	0.4	0.2
	0.5	31.25	8	0.4	0.2	0.1
	0.1	31.25	40	8	4	2

† Air mixing ratio – assumed mixing ratio inside hangar of 0.1 (low or poor), 0.5 and 1.
‡ Emission rate (g/hr) of chemical modified for proportion and application factor (assuming usage rate of PR-1750 of 5 kg over a 2 hour period.
¤ As the figures for hydrogenated terphenyls were not present in the output table of the report by Connell and Miller, they were derived from the emission rates after being corrected for the 1:10 mixing ratio of Part A to Part B[152].

C.204. Significance. The model calculations, suggest that overexposure to toluene vapours or hydrogenated terphenyls during the Wing DR Program would have been unlikely.

Estimate of Exposure levels during Fuselage Tank DR Programs

C.205. The estimates of the airborne concentrations (mg/m^3) of toluene and hydrogenated terphenyls in the fuselage tanks and hangar environment during the application of PR-1750 were not

149 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 21.
150 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 118.
151 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at pages 118-119.
152 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 118-119.

calculated[153]. However, extrapolation of estimates reported for toluene during other processes, suggest potential concentrations in the ranges tabulated below. It is estimated that concentrations of toluene in excess of 30 times the recommended Exposure Standards can be achieved in unventilated fuselage tanks during the application of PR-1750 (ie no mechanical ventilation, only natural ventilation) in a full deseal operation. In contrast, the airborne concentrations of toluene inside the hangar are predicted to be well under the Workplace Exposure Standards even with poor hangar ventilation.

Table C38: Ventilation Rates

Chemical	**Emission Rate (G) (g/hr)[1]**	**Predicted Air Concentration (mg/m^3)**			
		Fuel Tanks		**Inside Hangar**	
Ventilation Rates		**5 m^3/hr**	**10 m^3/hr**	**1 air change/hr**	**10 air change/hr**
TOLUENE (TWA for toluene is 377 mg/m^3)	62.5	12500	6250	7.5	0.075

Monitoring of Toxicant Concentrations[154]

C.206. Fumehood Tests. SIMTARS monitored the concentrations of various toxicants released after the application of PR-1750 Class A and Class B sealant in a fumehood[155]. In the tests with the Class A sealant, SIMTARS concluded that while '*the test indicated measurable quantities of MEK, toluene in the off-gassing vapours….the levels detected would not be expected to result in significant exposure in a ventilated area such as fuel tank*'. When the tests were carried out with PR-1750 Class B sealant, even lower vapour levels were detected. In both cases hydrogenated terphenyls were not detected in the off-gases leading SIMTARS to conclude, '*the exposure potential and consequent health risk from these agents is low*'.

C.207. Tests in Fuselage Tanks. SIMTARS also conducted considerable air sampling during application of PR-1750 inside aircraft fuselage tanks for real and simulated repair work. And concluded that the inhalation risk from the use of PR-1750 alone is low. It was further noted that prior to the application of PR-1750 sealant the surfaces are required to be first cleaned with MEK. This prerequisite increases the risk in applying PR-1750 to moderate[156]. The inhalation risk at the access to the tank was also concluded to be low.

Significance of Model Calculations and Monitoring Results

C.208. The model calculations and monitoring results suggest that it is most unlikely that RAAF personnel would have experienced overexposure to airborne toluene or hydrogenated terphenyls during the Wings DR Program. However, during the fuselage tank program, personnel inside the fuselage tanks may have been exposed to airborne toluene and MEK significantly in excess of the Workplace Exposure Standards if the tanks were not mechanically ventilated and protective breathing gear was not worn. As the levels in the hangar proper of toxicants emanating from the sealant are expected to have been very low, it is highly unlikely that personnel working inside the hangar would have been overexposed to these toxicants.

Dermal Exposure

C.209. SIMTARS concluded that the skin contact/skin absorption risk from the use of PR-1750 sealant is low, however, the use of MEK as a cleaner when applying the sealant may increase the risk to moderate[157].

153 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at pages 119.
154 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00.
155 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at pages 9-10.
156 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 11.
157 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 11.

C.210. Connell and Miller have assessed the hazard rating of dermal exposure to toluene vapour to be quite low under the conditions of intermittent contact with the entire skin[158].

Table C39: Estimated Skin Absorption Doses for Priority DR Chemicals Compared with Reference Doses (US-EPA) and Effect Levels

Chem	Average Daily Doses (mg/kg-day)	Hazard Quotient	RfD (mg/kg-day)	RfC (mg/m^3)	Scenario	Effect Levels
Toluene – vapour	0.02	0.1	0.2	0.4	Entire skin scenario, intermittent contact	No significant effects expected (possible neurotoxic effects)
Liquid	107	535	0.2		Hand and forearm intermittent contact	Possible changes in liver and kidney weights (animal studies) (NOAEL: 223 mg/kg-day)

C.211. Significance. Significant dermal exposure of personnel may have occurred when the application of sealant was combined with MEK cleaning. The level of exposure is difficult to assess and would depend on numerous factors including degree of skin contact with sealant and degree of contact of the sealant contaminated skin with liquid MEK.

158 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at Table 29.

SCOTCH WELD EC-2216 EPOXY ADHESIVE (Barrier)

Introduction

C.212. General. This section will consider the use of Scotch-Weld EC-2216 epoxy adhesive (or 'barrier') during the First, Second and Wing DR Programs. This product is a two-pack adhesive employed as a void filler and as a barrier to protect freshly applied sealant from degrading polyester sealant.

C.213. Composition. The full compositional data for EC-2216 is as follows:

Table C40: Ingredients of EC-2216[159]

%	Ingredient	CAS number	TWA/STEL
Part A			
40-70%	Polyamine (unspecified)	68911-25-1	Not available
45%	Kaolin	1332-58-7	2 mg/m^3
<0.1%	Carbon black	1333-86-4	3 mg/m^3
Part B			
70-80%	Bisphenol A/epichlorohydrin	20568-38-6	Not available
20-30%	Kaolin	1332-58-7	2 mg/m^3

Health Hazards[160]

C.214. Polyamine (unspecified). This substance is called an 'amine terminated polyether/carboxylic acid reaction polymer' in the 3M MSDS and is a trade secret compound. It is a polymer and does not have an appreciable vapour pressure and so would not be an inhalation hazard, however, it may have an irritating odour. A recent study has shown it to be a strong skin sensitiser.

C.215. Kaolin. Essentially non-toxic but can produce occupationally induced chronic pulmonary fibrosis (eg miners/clay workers).

C.216. Carbon Black. Discussed earlier (see PR-2911).

C.217. Bisphenol A/Epichlorohydrin Resin, Liquid. Discussed earlier (see MMS-425 primer).

State of Australian Knowledge: Workplace Exposure Standards

C.218. The Australian state of knowledge through time for the various components of EC-2216, as indicated by the Australian Workplace Exposure Standards, includes the following[161]:

Table C41: Australian Workplace Exposure Standards Through Time for EC-2216 Components

Name	Date	TWA		STEL		Comments
		ppm	mg/m^3	ppm	mg/m^3	
Amine terminated polyether/carboxylic acid reaction product	1978					
	1983-4					
	1988					
	1991					
	1995					
Carbon Black	1978		3.5			
	1983-4		3.5		7	

159 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 28.
160 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at pages 28-29.
161 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at Table 7.

	1988		3			
	1991		3			
	1995		3			
Kaolin	1978					
	1983-4				20	
	1988		10			
	1991		10			
	1995		10			
Bisphenol A /epichlorohydrin resin	1978					
	1983-4					
	1988					
	1991					
	1995					

C.219. There is no published exposure standard for the epoxy resin or the amine curing agent. The exposure limits for the kaolin and carbon black pertain to the dust forms, however, in the adhesive formulation these additives are physically fixed and accordingly do not pose the same hazard.

Air Monitoring in a Workplace Environment

C.220. The assessment by SIMTARS of EC-2216 inside a fumehood indicated that epichlorohydrin and diglycidyl ether of bisphenol A could not be detected[162]. SIMTARS concluded that the 'inhalation risk from the use of Barrier EC-2216 is low" and 'the exposure potential and consequent health risk is negligible'.

C.221. Significance. The inhalation risk to RAAF maintenance workers while using EC-2216 was low.

Dermal Exposure

C.222. The dermal exposure risk associated with EC-2216 was not investigated by Connell and Miller[163]. However, SIMTARS indicated that 'the skin contact/skin absorption risk from the use of Barrier EC-2216 is low, however the use of MEK as a cleaner when applying the barrier may increase the risk to moderate'[164].

C.223. Significance. Significant dermal exposure of personnel may have occurred when the application of EC-2216 was combined with MEK cleaning. The level of exposure is difficult to assess and would depend on numerous factors including degree of skin contact with sealant and degree of contact of the EC-2216 contaminated skin with liquid MEK.

Q4-2817 FLUOROSILICONE SEALANT

Introduction

C.224. General. Q4-2817 is a one-pack fluorosilicone sealant that was only employed in the wings program. The sealant cures by the reaction with atmospheric moisture generating acetic acid in the process which slowly out gasses from the sealant.

C.225. Composition of Formulation. The full compositional data for Q4-2817 is as follows:

162 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 9.
163 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01.
164 AMB.0130.192, SIMTARS, F111 Non-spray sealed fuel tanks monitoring program; 25 Oct 00 at page 11.

Table C42: Ingredients of Q4-2817[165]

%	Ingredient	CAS number	TWA/STEL
54%	Methyl-3,3,3-trifluoropropylsiloxane hydroxy terminated	68607-27-2	na
33%	Red Iron Oxide	1332-37-2	10 mg/m^3
6%	Cab-o-sil (amorphous silica)	Not available	10 mg/m^3
3%	Ethyltriacetoxysilane	17689-77-9	2.5
2%	Methyltriacetoxysilane	4253-34-3	na

Health Hazards[166]

C.226. Cab-o-sil (Amorphous Silica). Odourless grey powder. Irritating to the eye. Amorphous silica is not involved in silicosis. Chemically and biologically inert.

C.227. Red Iron Oxide. Iron oxide fume/dust is regarded as a nuisance dust. Avoid inhalation. Can cause a benign pneumoconiosis [siderosis].

C.228. Siloxanes and Silanes. These are organic silicon esters. They generally present a low health risk. However, depending on the chemical, irritation is possible with sensitive skin (contact dermatitis). Repeated eye exposure may produce conjunctivitis. Inhalation of vapour may aggravate a pre-existing respiratory condition such as asthma, bronchitis or emphysema. Siloxanes react with atmospheric moisture producing acetic acid.

C.229. Acetic acid. This organic acid is released during curing of the sealant and can cause contact burns to the skin and eyes. Skin and respiratory sensitiser.

165 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 32; and EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01, Table 3.

166 IOI.0052.040, SIMTARS, OH92433F8 - Non-spray sealed fuel tanks desk-top audit, 02 May 00 at page 32.

State of Australian Knowledge: Workplace Exposure Standards

C.230. The Australian state of knowledge through time for the various components of Q4-2817, as indicated by the Australian Exposure Standards, is sparse as shown in the following table[167].

Table C43: Australian Workplace Exposure Standards Through Time for Q4-2817 Components

Name	Date	TWA		STEL		Comments
		ppm	mg/m^3	ppm	mg/m^3	
Methyltriacetoxysilane	1978	0.5	0.7			
	1983-4	5	7			
	1988					
	1991					
	1995					
Ethyltriacetoxysilane	1978	0.5	0.7			
	1983-4	5	7			
	1988					
	1991					
	1995					
Red iron oxide	1978		5			
	1983-4		5		10	
	1988		5			
	1991		5			
	1995		5			
Fumed silica	1978					
	1983-4					
	1988					
	1991					
	1995		2			
Methyl-3,3,3-trifluoropropylsiloxane	1978					
	1983-4					
	1988					
	1991					
	1995					

Work Place Exposure

C.231. The principal routes of exposure are usually skin contact with the material and exposure to the vapours of acetic acid released from the curing sealant as it reacts with atmospheric moisture.

C.232. Q4-2817 was assigned a medium risk rating of four (4) by Connell and Miller[168]. Accordingly, this sealant was neither included in any physical monitoring program nor in calculations of potential workplace concentrations based on theoretical models. In addition, no consideration was given to dermal absorption of components in the fluorosilicone sealant. While no Workplace Exposure Standards are currently available for the siloxane, which is the major constituent in the formulation, it is expected that it would present a low risk inhalation hazard. Not only would the vapour pressure of this prepolymer be expected to be low but siloxanes as a chemical class, generally present a low health risk.

C.233. Significance. It was predicted that the inhalation exposure of RAAF personnel to Q4-2817 components to be low to medium with the degree of skin exposure remaining uncertain[169].

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167 EXP.0011.001, Anderson S, Connell D and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals - F111 Fuel Tanks; Nov 00 at Table 7.

168 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 92 Table 17.

169 EXP.0011.001, Miller G and Connell D, Toxicological Assessment of Deseal/Reseal Chemicals - F111 Fuel Tanks; 25 Jan 01 at page 146 Table 32.

Table C44: List of References

SIMTARS Report No. OH92683F1	F-111 fuel tanks deseal/reseal – laboratory simulation	20 December 2000
SIMTARS Report No. OH92683F2	F-111 fuel tanks deseal/reseal – laboratory simulation (Preliminary Results)	7 March 2001
SIMTARS Report No. 0H92683F3	F-111 fuel tanks deseal/reseal – laboratory simulation of PR-148	10 May 2001
SIMTARS Report No. OH92683F4	F-111 fuel tanks deseal/reseal – laboratory simulation of PR-2911	10 May 2001
Prof Des Connell, Dr Greg Miller, Ms Shelley Anderson	State of Medical and Scientific Knowledge Deseal/Reseal Chemicals – F-111 Fuel Tanks	November 2000
Prof Des Connell, Dr Greg Miller	Toxicological Assessment of Deseal/Reseal Chemicals – F-111 Fuel Tanks (including Appendix - Toxicological Database)	January 2001
Dr David Bromwich	Effectiveness of Selected PPE Against PR2911 and MMS425	To be produced by 21 March 2001
Dr David Bromwich	Estimates of Chemical Exposure During the First Deseal/Reseal Program	March 2001
Dr Greg Miller ENVIROTEST	Toxicological Assessment of SR51 Waste Disposal, RAAF Amberley	23 February 2001
Dr Greg Miller ENVIROTEST	Hazard Assessment - SR 51 and Warrill Creek	To be received by 16 March 2001
SIMTARS	MEK spray test	30 March 2000
SIMTARS	Non-spray sealed fuel tanks hazards	2 May 2000
SIMTARS	Non-spray sealed fuel tanks desk-top audit	2 May 2000
SIMTARS	F-111 Non-spray sealed fuel tanks monitoring program	25 October 2000
SIMTARS	Spray sealed fuel tanks hazard site inspection	18 August 2000
SIMTARS	Spray sealed fuel tanks desk-top audit	7 July 2000
SIMTARS	F-111 Residual spray sealed fuel tanks monitoring program	4 December 2000
DR David Bromwich	Methyl Ethyl Ketone (MEK) Permeation of DuPont Tyvek Barrier Man Coveralls	27 January 2001
DR David Bromwich	Methyl Ethyl Ketone (MEK) Liquid and Vapour Permentaion of DuPont Tychem SL	25 January 2001
DR David Bromwich	Methyl Ethyl Ketone (MEK) Permeation of Esdan Airline	29 January 2001
DR David Bromwich	Methyl Ethyl Ketone (MEK) Permeation of Norton (North) Butyl Gloves	22 January 2001
DR David Bromwich	Methyl Ethyl Ketone (MEK) Permeation of Ansell Sol-Vex Gloves	23 January 2001

CHAPTER 8 - PERSONAL PROTECTIVE EQUIPMENT

SUMMARY

8.1. Annex A summarises the personal protective equipment (PPE) used in the programs, and lists the suppliers in relation to the spray seal program at annex B. For the earlier programs, it was more difficult (comprehensively) to identify all of the PPE used and often not possible to identify the manufacturers or suppliers. PPE became more specific as both supplied and used over time and generally consisted of breathing protection by cartridge or air supplied respirator; skin protection by gloves, barrier cream, coveralls and booties; eye protection by goggles, face shield or full face respirator.

8.2. The RAAF did not supplement the instructions provided by the manufacturers on the use of PPE. Furthermore, the PPE was generally not tailor-made for the specific work environment, so that the instructions were generic only. Very little has been discovered of ad hoc instructions from manufacturers or suppliers about the use of PPE and, similarly, very little has been discovered in relation to the involvement of manufacturers in work methods, instructions or training in the use of PPE specifically focused on the deseal/reseal processes. Essentially, the Air Force demanded items of PPE from suppliers without reference to the purpose for which the PPE was intended.

The PPE Requirement

8.3. There was general recognition of the need for a significant range of PPE for all phases of the deseal/reseal activities. While some attempts were made to specify the requirements within the promulgated technical processes, most PPE was generally and loosely specified, being left to those who had the responsibility of applying the process to control it. Emphasis was on use of respirators, gloves, goggles or face shields and protective coveralls. The specific details of what was used and details of the consistency of its use are somewhat sketchy due to variations within programs and recollections fade with time. The PPE progressed to become better defined. It changed but in all cases the PPE supplied was specifically ordered by the RAAF based either on USAF standards and recommendations or on ENVHSURV approval of a locally available product. The evidence shows a maturing of the PPE management systems with it most consideration and care being applied to the spray seal program.

8.4. Protection required and provided was:

a. Inhalation protection provided by **respiratory protective devices**, either half-face or full-face organic chemical cartridge respirators, and breathing air supplied respirators.

8.5. Absorption or splash protection provided by:

a. **Gloves**; variously nitrile, butyl, viton, cotton, latex, kevlar, and silver lined;

b. hand **barrier cream**;

c. **coveralls** and **boots**; variously Saranex, Tyvec, Tychem, cotton, PVC, wet suits;

d. Eye protection provided by **goggles**, chemical goggles, **face shield**, air hood shield and visor integral to respirator mask.; and

e. Thermal protection provided for the spray seal program by MSA **cooling suits**.

8.6. Provision of PPE at the beginning of the first program was slow, causing most of the workforce to work without protection. More generally, supply of PPE was often inadequate, with tradespeople having to share equipment and improvise; various items of PPE were used beyond the point of them providing suitable protection. That said, adequate resources were normally available but often not utilised to the extent possible. There was a perception, encouraged by some supply system inertia, that resources were tight but only minimal evidence that senior executives felt such consequential constraint[1]. They were not usually informed if the difficulties to be in a position to make decisions. Poor performance of PPE was often evident but the usual tendency at the shop floor was to tolerate the inadequacy and made some effort to rectify the situation. However, limited resources and expertise in the workplace were often an inefficient way of seeking solutions. For example: 'We tried out 20 different types of gloves. We never - never got a good glove.'[2]

PPE Performance

8.7. Respirators. Respirators did not always fit properly. They became uncomfortable and distracting to the wearer after a period of time. Some of the respirators in use, had perished and had therefore lost an element of effectiveness. However, the main issues with respirators were the type of cartridge used and the cartridge life. There are a number of recorded instances when dust cartridges were issued for use in chemical environments. The lack of understanding by the workforce usually lead to these cartridges being used until the chemical odours were detected by the wearer. This obviously raised suspicions.

8.8. Gloves. Through the course of the inquiry, evidence was presented and received on the problems with gloves that had been selected as PPE. Light-weight gloves tended to be useless when used with many of the products, especially solvents. The more robust gloves presented significant difficulties where dexterity was necessary for the job at hand. The quotation referred to in paragraph five is an extreme case but nonetheless representative of the problem with gloves, and is worth repeating: 'We tried out 20 different types of gloves. We never - never got a good glove.'[3]

8.9. Coveralls. White cotton coveralls with elastic cuffs were widely used. They were collected and laundered by a civilian contractor. Disposable coveralls were also available and were commonly worn. The cotton overalls, were usually specified for use within tanks as a precaution against damage to tank linings. The presence of fluids meant that little protection from chemicals was provided. In the case of the Saranex coveralls used in the spray seal program, the ultimate realisation that they provided no protection to toluene was the defining moment for this Inquiry. Subsequent investigations by the 501WG IO found that coveralls that were suitable for chemical protection were not anti-static and were therefore unacceptable. This illustrates the point that OH&S solutions can be elusive and need considered attention.

Supply

8.10. As was the case with the supply of chemicals, the normal practice for PPE usage was to order the particular item rather than to specify its use and allow suppliers to recommend solutions. Where USAF instructions were specific, no independent validation of their listed product was performed by the RAAF. It is significant to note that a meeting was convened by the Principal Medical Officer in Support Command during 1983, the purpose of which was to address the policy issues relating to the introduction of hazardous chemicals and selection of

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1 In December 1989 and January 1990, a dwindling stock of PPE, especially respirator cartridges, was reported in 3AD. AMB.0081.107, Commanding Officer Report – No 3 Aircraft Depot; 01 Jan 90.

2 Transcripts\MAR27.DOC - Felton Transcript of Proceedings - Examination of P J Felton; 27 Mar 01 at page P-207.

3 Transcripts\MAR27.DOC - Felton Transcript of Proceedings - Examination of P J Felton; 27 Mar 01 at page P-207.

appropriate PPE. The meeting was initiated due to the revelation of a number of instances of the use of inappropriate PPE found during annual Command staff visits. The meeting agreed to issue two Defence Instructions (DI)[4], as well as the promulgation of more detail in the RAAF Ground Safety Manual AAP 6700.001. These policies were not directly transcribed with the change of the DI structure and the introduction of DOHSMAN, although the policy concepts prevail.

8.11. Currently “Blackwoods” is the contract supplier of PPE for Defence. If an item has already been identified and approved, PPE is ordered via the Electronic Purchasing Unit ('EPU') process. The items are ordered on an SQ230, which is processed through the 501WG Supply Section to the purchasing cell in 382SQN. The purchasing cell confirms the quotes/prices and processes the order. If the items are not already identified, the order must be authorised by 382 Environmental Health Section who will usually consult directly with the supplier and rely upon their expertise in identifying appropriate PPE[5].

Training

8.12. As stated in the summary, the RAAF did not supplement the instructions provided by the manufacturers on the use of PPE. Furthermore, the PPE was generally not tailor-made for the specific work environment, so that the instructions to the personnel using the PPE were generic. Very little has been discovered in relation to the involvement of PPE manufacturers in work methods, instructions or training in the use of PPE. Training in the use of PPE was as with most of the training associated with the four programs, on-the-job and under NCO supervision.

General Comment

8.13. The limited information contained in this chapter is a reflection of the relative lack of attention given to PPE when formulating work processes and the poor definitions contained in process specifications. More comment is given in chapters 9 and 11.

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4 DI(AF) TECH 29-1 Safety Precautions in the Use of Chemicals and Processes which Jeopardise the Health of Personnel; DI(AF) TECH 29-2 Safety and Health Hazards – Personnel Protective Equipment

5 IOI.0001.006, 301ABW/1804/14/278/Med Pt 1 (32), PPE Requirements for Sprayable Sealant Trail; 19 Jan 95.

ANNEX

Annex A – PPE Lists

1ST DESEAL RESEAL PROGRAM
LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS

CHEMICAL USED	PPE STIPULATED BY TECHNICAL INSTRUCTIONS	PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS	PPE SUPPLIED
MEK	Goggles Rubber Gloves Respirator[1]	Gloves Goggles Overalls Respirator	Rubber Gloves Overalls White - FSN 8405-66-035-3778 - 3779 Respirator (full face) - 4240-66-022-6030[2]
EC 3580	Goggles Rubber Gloves Respirator[3]	Gloves Face Mask Goggles Overalls	Rubber Gloves Face Mask - 4240-66-059-5536[4] Respirator (full face) - 4240-66-022-6030[5] Overalls White - FSN 8405-66-035-3778 - 3779
PR 148	Goggles Rubber Gloves Respirator[6]	Gloves Goggles Overalls Respirator	Rubber Gloves Respirator (full face) - 4240-66-022-6030[7] Overalls White - FSN 8405-66-035-3778 - 3779
MIL- C-38736	Goggles Rubber Gloves[8] Respirator[9]	No MSDS available.	Rubber Gloves Respirator (full face) - 4240-66-022-6030[10] Overalls White - FSN 8405-66-035-3778 - 3779
SR51	White Cotton Overalls Boots Polythene or Polyvinyl Gloves Respirator[11]	Self Contained Breathing Apparatus (if limits exceeded) Face Shield or Goggles Rubber Gloves Rubber Aprons & Boots[12]	Rubber Gloves Face Mask - 4240-66-059-5536[13] Overalls White - FSN 8405-66-035-3778 - 3779 Respirator (full face) - 4240-66-022-6030[14]

1 DI(A) AAP 7214.003-292-3.
2 LAV.0004.209, AMB.0055.105.
3 DI(A) AAP 7214.003-292-3.
4 LAV.0004.209, AMB.0055.105.
5 LAV.0004.209, AMB.0055.105.
6 DI(A) AAP 7214.003-292-3.
7 LAV.0004.209, AMB.0055.105.
8 DI(A) AAP 7214.003-292-1.
9 DI(A) AAP 7214.003-292-3.
10 LAV.0004.209, AMB.0055.105.
11 DI(A) AAP 7214.003-292-3.
12 Based on latest available MSDS (1994).
13 LAV.0004.209, AMB.0055.105.
14 LAV.0004.209, AMB.0055.105.

1ST DESEAL RESEAL PROGRAM LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
PR1750	Goggles, Rubber Gloves, Respirator[15] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[16]	Gloves Goggles Respirator/Face Mask Overalls	Rubber Gloves Respirator (full face) - 4240-66-022-6030[17] Face Mask - 4240-66-059-5536[18] Overalls White - FSN 8405-66-035-3778 - 3779

15 AAP 7214.003-292-1.
16 AAP 7214.003-292-3.
17 LAV.0004.209, AMB.0055.105.
18 LAV.0004.209, AMB.0055.105.

2nd DESEAL/RESEAL PROGRAM LIST OF PPE MATCHED TO THE KEY DSRS CHEMICALS			
CHEMICALS USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
Methyl Ethyl Ketone (MEK)	Goggles, Rubber Gloves, Respirator[19] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Gloves, nitrile or neoprene gloves, Air-supplied respirator.[20]	Gloves, Goggles, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Butyl Gloves - (NSN-8415-66-116-2314), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[21]
MIL-C-38736 (CLEANER) Toluene used as constituent in place of Naptha by HdH.	Goggles, Rubber Glovers, Respirator[22] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[23]	No longer available	Overalls White - (NSN-8145-66-110-2269), Nitrile Gloves - (NSN-8415-66-116-2310), Ansell Gloves - (NSN-8415-66-028-8131), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[24]
PR-148[25] Tolulene is a constituent.	Goggles, Rubber Gloves, Respirator[26] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[27]	Gloves, Goggles, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Nitrile Gloves - (NSN-8415-66-116-2310), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[28]

[19] **AAP 7214.003-292-1.**
[20] **AAP 7214.003-292-3.**
[21] **CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.**
[22] **AAP 7214.003-292-1.**
[23] **AAP 7214.003-292-3.**
[24] **CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.**
[25] **PR 148 was only used for the DSRS of the first two aircraft, as performed by HdH.**
[26] **AAP 7214.003-292-1.**

2nd DESEAL/RESEAL PROGRAM
LIST OF PPE MATCHED TO THE KEY DSRS CHEMICALS

CHEMICALS USED	PPE STIPULATED BY TECHNICAL INSTRUCTIONS	PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS	PPE SUPPLIED
PR-1750 (Mil-S-83430)	Goggles, Rubber Gloves, Respirator[29] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[30]	Gloves, Goggles, Face Mask, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Viton Gloves - (NSN-8415-66-116-2315), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[31]
EC-2216 (Barrier)	Goggles, Rubber gloves, Respirator.[32]	Gloves, Protective Glasses, Goggles, Face Mask, Overalls, Respirator.	Not found
Avtur, Jet A1	Not found	Face Visor/Goggles, Impervious Protective Clothing, Impervious Gloves, Respiratory Equipment (where excessive fumes are generated)	Not found

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27 **AAP 7214.003-292-3.**
28 **CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.**
29 **AAP 7214.003-292-1.**
30 **AAP 7214.003-292-3.**
31 **CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.**
32 **AAP 7214.003-2B3.**

2nd DESEAL/RESEAL PROGRAM LIST OF PPE MATCHED TO THE KEY DSRS CHEMICALS			
CHEMICALS USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
EC-3580B/A (Epoxy Barrier)	Industrial Goggles, Goggles, Rubber Gloves[33] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[34]	Gloves, Face Mask, Goggles, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Nitrile Gloves - (NSN-8415-66-116-2310), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[35]

[33] **AAP 7214.003-292-1.**
[34] **AAP 7214.003-292-3.**
[35] **CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.**

MANUFACTURER DETAILS FOR PPE USED DURING THE 2ND DSRS AND SPRAY SEAL PROGRAMS		
PPE ITEM	**MANUFACTURER**	**CASEBOOK REFERENCE**
BUTYL GLOVES	NORTON	AHQ.0003.245
VITON GLOVES	NORTON	AHQ.0003.245
ANSELL GLOVES	ANSELL EDMONT	AMB.0154.017
NITRILE GLOVES	-ANSELL EDMONT -NORTON	AMB.0154.017, IOI.0051.103 HDH.0012.283
4H GLOVES, SILVERLINED	SAFETY EQUIPMENT	AMB.0026.228
WHITE OVERALLS	-CHEMRAL -PROTECTOR SAFETY PTY LTD -JONES WORKWEAR (MELBOURNE)	AHQ.0003.068 LAV.0028.253 AMB.0030.130
COVERALLS, TYCHEM	PROTECTOR	AMB.0026.121
COVERALLS, DISPOSABLE	MSA	AMB.0026.121

MANUFACTURER DETAILS FOR PPE USED DURING THE 2ND DSRS AND SPRAY SEAL PROGRAMS		
PPE ITEM	**MANUFACTURER**	**CASEBOOK REFERENCE**
COVERALLS, DISPOSABLE	CHEMREL	AMB.0026.122
COVERALLS, SARANEX	DUPONT	IOI.0041.231
COOL SUIT	MSA	IOI.0041.231
RESPIRATOR, FULL FACE	MSA/AUER	AMB.0015.119
RESPIRATOR	-DRAGER -PROTECTOR SAFETY PTY LTD	AMB.0002.115 HDH.0012.259
RESPIRATOR, FULL FACE AIR SUPPLIED	SABRE	IOI.0041.231
RESPIRATOR, 1/2 FACE	PROTECTOR	AMB.0026.228
FILTER CARTRIDGE	UNISAFE	IOI.0041.231
CANISTER (MULTI-PURPOSE)	MSA/AUER	AMB.0015.119
FILTER, I/2 FACE	PROTECTOR	AMB.0026.228
SAFETY GOGGLES	UVEX SAFETY	IOI.0041.231

SAFETY GLASSES	UVEX SAFETY	IOI.0041.231
STANDARD SAFETY BOOTS	RAAF ISSUE	IOI.0041.231

SPRAY SEAL PROGRAM LIST OF PPE MATCHED TO KEY DSRS CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
Mil-C-38736	Industrial Goggles Rubber Gloves Respirator[36]	No MSDS available	MSA Cooling suits sarnex suits nitrile gloves (green) butyl gloves (black) Ansell/Edmont gloves (green) sabre breathing apparatus mask respirator masks white cotton overalls Sarnex booties safety glasses Drager full respirator on bottled air.
PR 2911	Whole body cooling system Sarnex coveralls Ansell/Edmont Nitrile Gloves or equivalent Full face air supplied respirator.[37]	PR 2911A – Gloves, overalls, goggles or face cartridge respirator , supplied air mask PR 2911B – Gloves, goggles, overalls, supplied air mask	MSA Cooling suits sarnex suits nitrile gloves (green) butyl gloves (black) Ansell/Edmont gloves (green) sabre breathing apparatus mask respirator masks white cotton overalls Sarnex booties safety glasses Drager full respirator on bottled air.

36 AAP.7021.005-1.
37 AAP.7214.003-292-5.

SPRAY SEAL PROGRAM LIST OF PPE MATCHED TO KEY DSRS CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
MMS 425	Whole body cooling system Sarnex coveralls Ansell/Edmont Nitrile Gloves or equivalent.[38]	Gloves Goggles Overalls Supplied air mask	MSA Cooling suits Ansell/nitrile gloves Sabre breathing mask White cotton overalls Sarnex booties safety glasses Drager full respirator on bottled air.
MEK	Full face air supplied respirator	Gloves, Goggles, Overalls, Half- face cartridge respirator	Overalls White - (NSN-8145-66-110-2269), Butyl Gloves - (NSN-8415-66-116-2314), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[39]
PR1750	Goggles, Rubber Gloves, Respirator[40] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[41]	Gloves, Goggles, Face Mask, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Viton Gloves - (NSN-8415-66-116-2315), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[42]

38 AAP.7214.003-292-5.
39 CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.
40 AAP 7214.003-292-1.
41 AAP 7214.003-292-3.
42 CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.

SPRAY SEAL PROGRAM LIST OF PPE MATCHED TO KEY DSRS CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
PR148	Goggles, Rubber Gloves, Respirator[43] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[44]	Gloves, Goggles, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Nitrile Gloves - (NSN-8415-66-116-2310), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[45]
EC3580	Industrial Goggles, Goggles, Rubber Gloves[46] Anti-static Coveralls, Knee Pads, Rubber-soled safety Shoes, Glovers, nitrile or neoprene gloves, Air-supplied respirator.[47]	Gloves, Face Mask, Goggles, Overalls, Respirator.	Overalls White - (NSN-8145-66-110-2269), Nitrile Gloves - (NSN-8415-66-116-2310), Safety Glasses - (NSN-4240-66-116-2001), Respirator - (NSN-4240-66-071-9778)[48]

43 AAP 7214.003-292-1.
44 AAP 7214.003-292-3.
45 CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.
46 AAP 7214.003-292-1.
47 AAP 7214.003-292-3.
48 CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section; July 1992.

WINGS DESEAL RESEAL PROGRAM LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
EC2216	Goggles Rubber gloves Respirator	Safety glasses or Goggles Cemical protective gloves Safety footwear; Overalls Rspirator [49]	"Ansell" pink rubber gloves[50] Nitrile gloves (NSN-8415-66-116-2310)[51] Buytl gloves[52] White cotton overalls[53] Goggles (NSN-4240-66-116-2001)[54] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[55] "Tyvex" coveralls .[56]
MEK	Goggles Rubber gloves Respirator	Safety glasses or chemical goggles; polyethylene or butyl rubber gloves; Safety footwear; Overalls or impervious protective clothing; Respirator[57]	Buytl gloves[58] White cotton overalls[59] Goggles (NSN-4240-66-116-2001)[60] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[61] "Tyvex" coveralls .[62]

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49 **CHEMWATCH.**
50 **AMB.0026.016.**
51 **AMB.0026.036.**
52 **AMB.0026.036.**
53 **AMB.0026.016.**
54 **AMB.0026.025.**
55 **AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.**
56 **AMB.0026.016.**
57 **CHEMWATCH.**
58 **AMB.0026.036.**
59 **AMB.0026.016.**
60 **AMB.0026.025.**
61 **AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.**
62 **AMB.0026.016.**

WINGS DESEAL RESEAL PROGRAM **LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS**			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
PR148	Goggles Rubber gloves Respirator	Safety glasses or goggles Nitrile rubber or PVC gloves Safety footwear Overalls Respirator [63]	Ansell" pink rubber gloves[64] Nitrile gloves (NSN-8415-66-116-2310)[65] White cotton overalls[66] Goggles (NSN-4240-66-116-2001)[67] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[68]
PR1750 A2, B2. B6	Goggles Rubber gloves Respirator	Safety glasses or goggles Neoprene rubber or butyl rubber gloves Safety footwear Overalls Respirator[69]	Buytl gloves[70] White cotton overalls[71] Goggles (NSN-4240-66-116-2001)[72] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[73]

63 CHEMWATCH PRC Desoto.
64 AMB.0026.016.
65 AMB.0026.036.
66 AMB.0026.016.
67 AMB.0026.025.
68 AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.
69 CHEMWATCH PRC Desoto.
70 AMB.0026.036.
71 AMB.0026.016.
72 AMB.0026.025
73 AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.

WINGS DESEAL RESEAL PROGRAM LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
Q4-2817	Goggles Rubber gloves Respirator	Safety glasses or chemical goggles Polyethylene or PVC gloves Safety footwear Respirator [74]	Nitrile gloves (NSN-8415-66-116-2310)[75] Buytl gloves[76] White cotton overalls[77] Goggles (NSN-4240-66-116-2001)[78] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[79] "Tyvex" coveralls
TOLUENE	Goggles Rubber gloves Respirator	Gloves Overalls Goggles Half-faced Respirator	Ansell" pink rubber gloves[80] Nitrile gloves (NSN-8415-66-116-2310)[81] Buytl gloves[82] White cotton overalls[83] Goggles (NSN-4240-66-116-2001)[84] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[85] "Tyvex" coveralls

[74] **CHEMWATCH DOW CORNING**
[75] **AMB.0026.036**
[76] **AMB.0026.036**
[77] **AMB.0026.016**
[78] **AMB.0026.025**
[79] **AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.**
[80] **AMB.0026.016**
[81] **AMB.0026.036**
[82] **AMB.0026.036**
[83] **AMB.0026.016**
[84] **AMB.0026.025**
[85] **AMB.0026.025, CBR.0024.036 PPE Used at 501WG Deseal/Reseal Section. July 1992.**

WINGS DESEAL RESEAL PROGRAM **LIST OF PPE MATCHED TO THE KEY DESEAL RESEAL CHEMICALS**			
CHEMICAL USED	**PPE STIPULATED BY TECHNICAL INSTRUCTIONS**	**PPE STIPULATED BY THE LATEST AVAILABLE MATERIAL SAFETY DATA SHEETS**	**PPE SUPPLIED**
AVIATION TURBINE FUEL (JET A1)	Goggles Rubber gloves Respirator	Face visor or Goggles Gloves Impervious Protective clothing Respiratory Equipment	Ansell" pink rubber gloves[86] Nitrile gloves (NSN-8415-66-116-2310)[87] Buytl gloves[88] White cotton overalls[89] Goggles (NSN-4240-66-116-2001)[90] Chemical/oil resistant leather boots Half-faced respirator (NSN-4240-66-071-9778)[91] "Tyvex" coveralls

86 AMB.**0026.016.**
87 **AMB.0026.036.**
88 **AMB.0026.036.**
89 **AMB.0026.016.**
90 **AMB.0026.025.**
91 **AMB.0026.025, CBR.0024.036, PPE Used at 501WG Deseal/Reseal Section. July 1992.**

CHAPTER 9 - WORK INSTRUCTIONS, METHODS AND PRACTICES

INSTRUCTIONS

9.1. Defence being a typical bureaucracy, there are many levels of regulation and instruction that govern the development and authorisation of work processes. The actual instructions and their detail for the four DR programs varied considerably between and across programs so it is difficult to present prevailing guidance at any snapshot in time. The detail of the work procedure, however, is one area where there is high traceability and confidence. An overview of the technical hierarchy of instructions is provided at annex A. While this hierarchy is comprehensive, focus in this report will be on the deseal/reseal instructions themselves. Suffice to say that promulgation of the technical procedures was compliant with extant regulation and policy. Additionally, the second program was contracted to an independent contractor, Hawker de Havilland, whose performance was governed by the conditions in its contract. Hence, save for where it is expressly stated otherwise, the comments in this chapter are confined to the first, wings and spray seal programs.

9.2. With respect to the work instructions, detail and comment has already been given in each of the chapters describing the four programs and it is not the intention to repeat that here. This information is evident in those chapters or can be readily found through the cross-reference listing at Appendix 1. The work methods relating to the on-aircraft work are detailed in the AAP 7214.003-292 and AAP 7214.003 – 3 series of publications. Discussion in this chapter is therefore focussed on work practices where there was some discretion in the absence of detailed instructions. Those work routines and processes that were well defined but may not have been followed are covered in chapter 11.

9.3. Knowledge of Instructions. The technical instructions for work on aircraft are comprehensive. The publications were well known to the SNCOs controlling the work, as would be expected. However, the tradespeople on the floor relied heavily on worksheets or their supervisors for information and were generally ignorant of the detail contained in the governing AAPs. In reality, the closer you get to the shop floor the less likely publications are to be read. Tradespeople are, and were, simply interested in their task. A statement under safety instructions in AAP 7214.003-292-3 to the effect: '[p]ractically all materials used in the deseal/reseal operations are toxic and/or flammable … Extreme care should be exercised in the use of these materials … Avoid excessive breathing of fumes and wear protective clothing (gloves, goggles, masks, etc) … ', proved of little utility (as a warning) as it never became evident to the general workforce.

9.4. Worksheets. Worksheets are the primary means by which work on the shop floor is controlled. They are a certified record of work completed and an instruction and check for work needing to be done. The content is drawn from the authorised procedures promulgated in the relevant AAP. Given that shopfloor reference to the AAPs is rare, the role of the worksheet becomes critical. Worksheets used for the DR activities seem to have been suitable; with the exception of the spray seal program where the evidence suggests they were not accurate or complete and their usage lapsed.

The Working Environment

9.5. The work in 501WG Fuel Tank Repair Section (FTRS) was dirty, uncomfortable and onerous. The hand cleaning of tanks and finite removal of old sealant using dental picks was a particularly laborious phase of the work. FTRS was not a popular work area although the nature of the work did tend to create quite a bond within the section. Those within the section often felt isolated and ignored. On the three fuselage programs, work is characterised by long periods spent within the confined spaces of the four main fuselage tanks; the A2 tank being particularly restrictive with barely room for one person in the enclosed work area. This confinement was substantially amplified during the spray seal program because of the time it took to suit and rotate the technicians, which invariably discouraged a change other than at the end of a shift. Some airmen therefore spent up to eight hours in the confined spaces of the tanks in claustrophobic protective suits because production schedules were tight and no limits had been set on duty periods.

9.6. Work on the first program was distinguished by the use of SR51 desealant and the necessary isolation of the 'rag hangar' because of obnoxious odours. Despite the ideal that the SR51 would be contained within a closed system, there were many instances where airmen had to work directly with the chemical, especially during the disposal phase. The fact that exposure had occurred is evidenced by the smell that attended them. Many of the witnesses complained of social isolation because of their smell. The approach to OH&S matters could best be described as casual due to the lack of sound information on the toxicity of the chemicals they used and a macho approach to work generally.

9.7. The second program is distinguished by the reasonably tight controls that were instigated through the process of contract negotiation. Hazards were significantly reduced by the removal of the SR51 chemical desealing phase. The main concern with this program was with regard to the high-pressure water pick used to remove old sealant, a process which has no long-term implications. The primary concern for this Inquiry is the repetitive use of the solvents within the confined spaces of the fuel tanks. This concern was the subject of ongoing investigation and attention by the contractor through the three years of the program

9.8. The spray seal program was distinguished by the use of the spray sealant and its primer[1], and the time airmen could spend within the tanks during any one-duty period in very restrictive PPE. As noted above, airmen on occasions spent inordinate time in cumbersome PPE and many were at the point of exhaustion when their shift ended. One of the main problems was the lack of a dedicated facility, which forced the section into adopting a tight production schedule. This, plus market testing imperatives on the Wing as a whole, led to constant pressure on all concerned

9.9. Finally, the wings program, which by comparison was distinguished by the fact that there was no chemical desealant and work was not conducted in a confined space. This program had the advantage of being an open work area and, because the wing was manoeuvrable, the water pick could be used at waste height and the wing itself could be moved to the open air, weather permitting. Notable was the 'all in' period when the top plank was reinstalled because of the working life of the sealants.

WORK PRACTICES

9.10. Acceptance of Extant Processes. The evidence of most managers and supervisors, in the absence of any contrary evidence, is that they accepted the validity of work processes and practices on taking up their appointments. They quite reasonably trusted the development stages of the programs and could have confidence in the people then managing and supervising the work.

9.11. Questioning the Processes. Most Air Force managers believed there was a culture where questioning was commended. They felt that individuals of any rank who perceived problems in maintenance processes or standards would voice their opinion in the knowledge that they will be listened to. However, while some airmen were outspoken, the great majority did not have the knowledge or experience to question matters unless they had a specific

[1] These chemicals were judged in Volume 2 Part 1 Chapter 7 of this Report to be particularly toxic chemicals.

reference that aroused serious concern. This, coupled with their trust in the 'system', meant that in reality few process and work practice issues were pressed from the floor.

9.12. Supervision. Levels of supervision, of course, varied considerably. There are also different perspectives and different recollections to consider, as well as judgments on the relative weighting needing to be given to evidence relating to specific incidents. On the whole, supervision seems to have been representative of the general service environment and did not take into account the particular hazards that were evident within FTRS, probably because the hazards and risks were rarely fully quantified. Criticism of inadequate supervision by many witnesses is now evident, in retrospect, in work areas where there is judged to have been unacceptable consequences. Most of this comment is in relation to enforcing the use of PPE. However, one thing is evident and that is a good number of supervisors appreciated the difficult work their section performed and put a great amount of effort into improving working conditions.

9.13. Work Pressure. The issue of work pressure is addressed in full in volume 1 chapter 4. It is a pervasive issue and acknowledged by nearly every witness. Two representative statements from the first program and one from the spray program are:

a. 'The workplace culture was that getting the job done was paramount and PPE was not even discussed as being relevant. The whole process was task-orientated.'[2];

b. 'The general attitude of Deseal/Reseal staff to the use of PPE was that items would only be used if it was practical to use them and get the job done because getting the job done was the priority.'[3];and

c. 'I was frustrated at having to adhere to time limits which were completely unrealistic and in the attempt to adhere to those time limits the chances increased of injury to my troops. … Whilst the procedures settled somewhat, the intensity of the spray seal work output increased in the second 15 months of my posting. This countered some of the gains.'[4].

9.14. Off-Aircraft Work. Instructions for handling and applying the various chemicals were comprehensive when specifying a process to be employed on-aircraft, but less so when handling the chemicals or using them off-aircraft. The OH&S practices and cautions regarding protection from chemicals during work on aircraft seem not to have been enforced as attitudes. For example, practices used for decanting and mixing the chemicals, for waste disposal, and when cleaning equipment and self, were far more casual than in the more regulated on-aircraft work environment. These are also work areas that are usually poorly supervised. In many cases, witnesses stated that PPE was for comfort as much as protection so when, for example, cleaning jobs could be done fairly quickly, PPE was seen as more of an encumbrance and was often not used. Three examples to demonstrate this point, two from the first program and one from the spray program, are:

a. 'Flushing of Deseal Rig. The 4000L Deseal Rig required cleaning after the deseal operation was complete. The procedure omits to prescribe the method of cleaning the Deseal Rig of waste before the next step of filling the Rig with ED500';

b. 'I can recall one occasion I was required to hop into the vat (which stored the SR51) to hose it out. The vats were extremely large. I would estimate that they would have been approximately 5 x 5 metres and approximately chest height. While I was hosing the vats down the spray back from the vat caused me to be soaked in the SR51 and water solution.'[5]; and

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2 WIT.0496.001, Witness Statement of Peter Lecinski; 12 Dec 00 at par 23.
3 WIT.0302.001, Witness Statement of Leon Micheal Sunnerdale; 21 Nov 00 at par 51.
4 MAN.0006.001 (at 039), Witness Statement of Mark William Orwin; 21 Mar 01 at pars 197-199.
5 WIT.0456.001, Witness Statement of Francis Bernard Cooper; 10 Jan 01 at par 57(iii).

c. 'There was no separate procedure for removing your suit. You would be covered in the sealant but at that time you were simply so anxious to get out of the suit. This was normally done outside the hangar and all the suits and other apparatus were gathered together and disposed of. There was a risk of making contact with chemicals but at the time you didn't care – you just had to get out of those suits.'[6].

9.15. Equipment Maintenance. This aspect of operations, as with views on supervision and use of PPE, was exhibited by a variety of opinions from witnesses. With the exception of the second program which had both, there were policies but often no detailed servicing plans or calibration schedule for the PPE and support equipment in use. Most safety equipment requires periodic servicing, and this maintenance is essential to ensuring proper functioning. Breakdowns occasionally added to the frustration and pressure of work. Inherited equipment from SM-ALC for the spray seal program was especially difficult to manage.

9.16. Access. General access to the deseal areas and spray seal activities was limited to those who worked therein. Access was controlled by means of barricades and warning signs.

9.17. PPE Use. The safety thinking seems to have been focussed on acute exposure, to which many were prepared to take their chances if availability or comfort of PPE was a problem, as they reasoned they would get some forewarning and would recover. The insidious and chronic effects were not really contemplated. The more immediate effects to the skin were viewed as something which could be tolerated, the expectation being that conditions would clear-up once posted from the work environment; likewise any headaches, light headedness, etc.

9.18. Ventilation. Ventilation was not well specified in AAP 7214.003-292-1 for the first or second programs. However, some additional requirements were resolved for the second program as noted in chapter 4. General maintenance practice was to pump air into tanks from mobile air conditioners but the flow rate and its effectiveness, particularly in the smaller tanks where airflow was interrupted, was not checked. Specific ventilation requirements were required for the spray seal program, but were not followed. Comment on this is given in chapter 11.

9.19. Rescue Procedures. Rescue and emergency procedures were poorly specified and observed. Only more recently have precautions been properly identified but these policies were not necessarily well applied. At the time of the Spray Seal Program, policy as to rescue procedures was released in Annex J to RAAF Supplement No 5 of AAP 7027.001-1[7]. Rescue procedures for confined space entry were issued in Appendix C to Annex A of BLI 3-3-20[8]. 501WG Standing Instructions were also issued containing rescue procedures[9]. Rescue procedures released with the approval to re-enter F-111 fuel tanks are now appropriately compliant.

Audit

9.20. Audits were an irregular feature of the work in FTRS. This variation was due to: changing regulatory requirements; changing RAAF organisation; to individual initiative once Command staff visits ceased in 1991; and to prevailing issues and distractions. FTRS was generally viewed as a work area with difficult and hazardous tasks. Many of the audits found problems that may or may not have been followed-up, or gave some false confidence to managers that work conditions were generally acceptable. By way of illustration:

a. MRL staff effectively conducted an audit 7-9 Mar 1979[10]. The report endorses 3AD practices. It also records an opinion that lack of knowledge outside 3AD

6 WIT.0382.001 (at 014), Witness Statement of Heath Ashley Joiner; 8 Jan 01 at par 48.
7 IOI.0028.099, AAP 7027.001-1, Annex J to RAAF Supplement No 5; 04 Jul 95.
8 AMB.0047.033, BLI 3-3-20, Appendix C to Annex A ; 15 Feb 99.
9 AMB.0050.001, 501WG SI(LOG) 3-108-5-1; date unknown.
10 See MRL reference 64/71/3, R3/12/10 of 16 Mar 79.

had lead to speculation on the hazards re SR51 as 'exaggerated to an extraordinary degree';

b. Queensland Government Industrial Medicine Branch measured levels of thiophenol in the rag hangar in June 1979 and determined that the levels within the hangar generally were below TLV of 10mg/cubic metre, even though the thiophenol could be detected by smell; and

c. An ENVHO Amberley report dated 12 March 1985 recorded that lint free, but pervious, cotton overalls were being used by FTRS and directed the use of impervious tyvek overalls instead. The same report also directed use of nitrile gloves in lieu of the inadequate and inappropriate 'Ansell' gloves. Breathing air supply was tested and found compliant.

9.21. The report of a follow-up survey to the above ENVHO report was issued 12 July 1985. This second report expresses some exasperation that not much action had resulted since the issuing of the first report. Issues contained in that report were that: cotton overalls and 'Ansell' gloves were still in use, there was insufficient knowledge of chemicals in use and, especially that there was a lack of reaction to the advice offered four months earlier: 'Poor supervisor attitudes, poorly informed or unmotivated safety officers, the dollar sign ruling PPE choice, and lack of coordinated section research have all been obvious.[11]'

9.22. An EH survey of FTRS in Nov 86 found the section to be in a reasonable state, but recorded inadequate respiratory protection and improper storage of PPE as two of the three issues.

9.23. An occupational health survey of the FTRS was conducted and released on 12 Dec 88. Its purpose was to determine the toxicological nature of the chemicals being used in the Wings Program, investigate the adequacy of the PPE in use, and ascertain the need for respiratory protective equipment when in contact with the chemicals. The investigation highlighted some inadequacies in the PPE, such as nitrile gloves offering little protection against MEK.

9.24. The Support Command staff visit in 1989, with the Command Environmental Officer attending for the first time, raised a number of serious concerns regarding chemical/fume exposure and appropriate PPE in a number of 3AD workshops.

9.25. A Support Command environmental health team visited 3AD/501WG in Feb 1991 and again in May 1992, acknowledging that annual Command visits were necessary. That said, in 1991 they reported that they were satisfied that a rolling audit program conducted by ENVHO Amberley during the previous 12 months had covered the relevant area. Issues mentioned (warranting attention) were the control of, and protection against, fumes (as per the 1989 report), and concern with the amount of sealant workers were getting on their skin during wing resealing.

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11 AMB.0026.027 (at 028), Solvent Mil-C-38736 and General Chemical PPE; 02 Sept 1985.
AMB.0026.016, Environmental Health Survey – 3AD Deseal/Reseal Inspection 2; 12 Jul 85.

9.26. Workcover Techsource audited FTRS in March 1993.

9.27. 501WG instituted an Occupational Health and Safety Self-Review during 1996 to audit compliance with AS14000.

Training

9.28. Procedurally, work practices were straightforward. The same cannot be said for the hazards and risks associated with the work which were complicated issues. With the exception of the second program as discussed in chapter 4, each of the DR programs was preceded by a prototype servicing. For the first and spray seal programs, procedures were validated under the supervision and direction of experienced staff from Sacramento. The prototype for the first program also had the benefit of five RAAF SNCOs/NCOs who had spent some weeks of OJT at Sacramento. The only formal training requirements on any of the programs were F-111 Familiarisation (Ground Handling) Course, F-111 Confined Space Entry Course from about 1993, and instruction on the use of the water pick and the walnut seed blaster (wing program). The rest of the training was informal on-the-job (OJT), usually conducted by corporals and senior LACs. The use of a training video produced by the USAF in the 1970s was shown to many as part of induction training to the earlier programs, but certainly not to all. Training for the HDH workforce was more comprehensive: for example, on laying sealant, especially if the aircraft trade background of any employee was not strong.

9.29. In 1980, an attempt was made to institute a course, which was first presented at the 3AD hangar. The course was not a prerequisite for working at FTRS and was held at a time when there was some slack in the program. Ultimately, the course was suspended because of the work schedule[12].‘

9.30. The Confined Spaces Entry Course at Amberley was commenced in early 1993. AAP7027.001-1 Supplement 5 was previously dated 5 July 1995 and mandated confined space and other training when working within fuel tanks, including medical staff delivering one element. The Supplement was renewed in December 2000. A review of the course when it was transferred to 82WG late in 1997 concluded that health and hygiene aspects specified by the Australian Standard on confined space entry were not covered. The Board notes that this course has now been substantially improved, primarily as a consequence of the focus provided by the 501WG IO.

9.31. The following statement is probably representative of many attempts to raise awareness in the absence of formal knowledge on hazards: ‘The SGTs and the FSGT managed the problem by discussing the use of respirators (and also the use of Mil-Spec) with all the troops in a meeting … We as SNCOs did all we could do to minimise this risk by calling the meeting and raising the section’s awareness of the issue[13]’; A Hazardous Substance Course was initiated internally by 3AD in 1991 but its fate was not determined.

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12 MAN.0049.001, Witness Statement of James Malcolm Harding; 20 Mar 01 at pars 58-61.

13 WIT.0049.001, Witness Statement of James Malcolm Harding; 20 Mar 01 at par 108 (b).

F-111 Deseal/Reseal Board of Inquiry

ANNEX

Annex A – Hierarchy of Technical Regulations and Instructions

HIERARCHY OF TECHNICAL REGULATIONS AND INSTRUCTIONS

Aircraft Maintenance Process Regulation

***Defence Act* 1903**

- CAF is the airworthiness authority for State aircraft.

Air Force Regulation 688

- CAF may issue orders and instructions deemed necessary for proper conduct of State aircraft operations.

Defence Instructions

9A.1. DI(AF) OPS 1-15 Type Certification of State Aircraft and In-Service Management of Airworthiness

9A.2. DI(AF) LOG 1-102 Division of Engineering Responsibilities Between Department of Defence (Air Force Office) and Commands

9A.3. DI(AF) LOG 1-104 Systems Engineering

9A.4. DI(AF) LOG 1-105 Quality System Standards for Logistic Support of Technical Equipment

9A.5. DI(AF) LOG 1-106 Application of Integrated Logistics Support in the RAAF
Maintenance support, facilities, training and a skilled workforce are elements of ILS.

9A.6. DI(AF) LOG 2-101 The Discipline of Engineering and its Application to RAAF Aircraft and Other Technical Equipment
Prescription of maintenance, support equipment and tooling, facilities and qualifications of technical personnel are integral to the engineering function.

9A.7. DI(AF) LOG 2-105 Design Acceptance

9A.8. DI(AF) LOG 3-102 Maintenance Policy for Technical Equipment

9A.9. DI(AF) LOG 3-108 Supervision and Inspection of Aircraft and Aircraft Equipment Maintenance (superseded by AAP 7001.059 sect 2, ch 5)
Includes responsibilities of, inter alia, section heads and supervisors when conducting maintenance.

9A.10. DI(AF) LOG 3-112 Management of the Performance of Technical Equipment Maintenance (superseded by AAP 7001.059 sect 2, ch 4)
Task authorisation control.

9A.11. DI(AF) PERS 33-1 Training (PAF) – Organisation and Responsibilities

9A.12. DI(AF) PERS 34-18 RAAF Record of Training and Employment
Superseded DIs(AF) TECH (applicable for the first, second and wings programs)

9A.13. DI(AF) TECH 2-1 Division of Technical Responsibilities

9A.14. DI(AF) TECH 2-2 Technical Responsibilities – Headquarters Support Command

9A.15. DI(AF) TECH 2-5 Technical responsibilities of Depot Level Maintenance Facilities

9A.16. DI(AF) TECH 3-14 Responsibilities of Airmen of Technical Musterings

9A.17. DI(AF) TECH 5-2 Technical Instructions and Publications

9A.18. DI(AF) TECH 5-5 Unit Maintenance Orders

9A.19. DI(AF) TECH 17-1 RAAF Maintenance Policy for Technical Equipment

9A.20. DI(AF) TECH 17-6 Maintenance of RAAF Aircraft

9A.21. DI(AF) TECH 25-11 Supervision and Inspection of Technical Maintenance Operations

DGTA Sponsored Publications

9A.22. AAP 7001.006-1&2 Maintenance Control and Associated Documentation

9A.23. AAP 7001.038-1 Maintenance Requirements Determination
Chapters 3,4 and 5 cover determination requirements and criticality analysis.

9A.24. AAP 7001.053 Technical Airworthiness Management Manual
Policy on control of technical publication content is lacking.

9A.25. AAP 7001.054 Aircraft Design Requirements Manual

9A.26. AAP 7001.059 Aircraft Maintenance Management Manual
Occupational Health and Safety, Sect 5
Conduct of Maintenance, Sect 2

9A.27. AAP 7002.012-2 Fuels and Lubricants Handbook

9A.28. AAP 7021.005-1 Corrosion Control of Aircraft

9A.29. 2.8 AAP 7021.014-2 Aircraft Materials and Corrosion Protection Handbook

9A.30. AAP 7027.001-1 Inspection and Repair of Aircraft Integral Tanks and Fuel Cells
Current basic issued Jul 95, and predecessor (T.O. 1-1-3 issued 24 Aug 89)

Training Publications

9A.31. AAP 2002.001 Manual of Training Policy and Procedures

9A.32. AAP 2320.101-1M Occupational Specifications Aircraft Engineering Trade Group.
Lists briefly the hazards that can be faced as part of trade employment

SRLMSQN Sponsored Publications
F111 General

9A.33. AAP 7214.003-2-8-1, Fuel and Inflight Refuelling Systems F111C

9A.34. AAP 7214.003-3B1-B5, Repair and Overhaul Instructions F111C

9A.35. AAP 7214.003-3-2 (covers 1F-111A-3-23, Wing D/R; the 292-4 was never issued)

Deseal/Reseal Specific

9A.36. AAP 7214.003-292-1, Deseal/Reseal of F111C Fuselage Fuel Tank Procedures

9A.37. AAP 7214.003-292-2, Fuselage D/R Worksheets

9A.38. AAP 7214.003-292-3, Deseal/Reseal Health and Environment

9A.39. AAP 7214.003-292-5, Spray Seal Procedures

9A.40. S29 Special Servicing, Wing D/R procedure

9A.41. S37 Special Servicing, Fuselage Fuel Tanks Deseal/Reseal, 2nd program
Modification 7214.003-100-292, Fuselage Fuel Tanks Deseal/Reseal, 1st program

9A.42. STI F111C/33

501WG Standing Instructions and corresponding 3AD Unit Maintenance Orders
82WG Confined Space Entry Course CTOs

Commonwealth/HdH (Vic) Standing Offer PV8440, dated 20th December 1990 - Contract for 2nd Deseal/Reseal Program

CHAPTER 10 – OCCUPATIONAL HEALTH & SAFETY

REGULATORY FRAMEWORK

10.1. The Royal Australian Air Force (RAAF) Safety Management System has evolved largely in response to the development of legislative and community standards since the introduction of the F111C into service on 1 June 1973. Prior to the OH&S Act, the RAAF Safety Management System was detailed in the RAAF *Manual of Ground Safety*. The Manual was aimed at establishing a standard that would equal or surpass the relevant State and Territory legislative standards and the common law duty of care of the time. Over the various Deseal/Reseal Programs the Safety Management System has developed with the view of ensuring the health and safety of all personnel in RAAF workplaces.

FIRST DESEAL/RESEAL

Safety Management System

10.2. The Defence Safety Management System at the time of the First Deseal/Reseal consisted of a combination of the RAAF *Manual of Ground Safety* and other health, safety, quality and technical publications that addressed specific functions.

10.3. The Manual was aimed at establishing a standard that would equal or surpass the relevant State and Territory legislative standards and the common law duty of care. It focussed on the minimisation of accidents and incidents that might cause personal injury damage to equipment or interrupt production.

10.4. The object of the Manual was to put in place a system with respect to unplanned and uncontrolled events, which constituted accidents. The Manual aimed to address such matters as accident causation, improper attitudes/ habits, unsafe conditions and acts. The philosophy behind the Manual of Ground Safety was to ensure that accidents were prevented, hazards were corrected and adequate training was provided to facilitate the adherence to such policy[1]. The emphasis was on the minimisation of unplanned and uncontrolled events that could effect the workplace. It identified in detail, certain unsafe acts[2] and unsafe conditions[3] that could occur in the workplace and outlined the process for accident prevention[4], corrective action[5], workforce motivation[6] and training.

10.5. The aim of accident prevention was to identify potential hazards and instigate controls and corrective action prior to the occurrence of injury or loss of life. Accident prevention was said to include:

a. a recognition of the potential hazards,
b. taking instant corrective action (where possible),
c. (where b. is not possible) making personnel aware of the hazard and instructing them on how to avoid possible injury,
d. monitoring procedures,

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1 PUB.015A.001, DI(AF)AAP6700.001; Chapter 1 Section 1.
2 PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page 1-1-2 par 105.
3 PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page 1-1-3 par 106.
4 PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page 1-1-3 pars 107-111.
5 PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page 1-1-4 par 112.
6 PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page 1-1-4 par 113.

e. selection of a remedy,
f. pro-active measures to eliminate risk (including the establishment of Ground Safety Committees), and
g. safety surveys/audits.

Safety Standards

10.6. Central to the Safety Management System for the First Deseal/Reseal Program were a series of standards on safety. These were contained in Annex A to Chapter 3 Section 1 of the Manual. Insofar as Deseal/Reseal was concerned the relevant Standards of safety were:

a. Desealing of aircraft – DEF (AUST) 378,
b. Industrial skin cleansers (solvent type) – SAA AS 1223,
c. Code for industrial accident prevention signs – SAA AS-1319,
d. Code of general principles for safe working in industry – SAA AS 1470,
e. Code of practice for respiratory protection – SAA AS 1715,
f. Respiratory protection devices – SAA AS 1716,
g. Flammable and combustible liquids code – SAA AS 1940,
h. Industrial safety gloves and mittens of leather, PVC and rubber (excluding electrical and medical gloves) – SAA AS Z4.

10.7. The Standards of Safety List identified numerous standards and gave a brief outline of the nature of the standard. It was the responsibility of the supervisor to be familiar with relevant standards and to train members in the application of the relevant standard. However, there appeared to be little by way of chemical standards as recalled by one witness who stated 'I do recall that I never saw any safety data sheets for any of the chemicals which were used if in fact these sheets were available [7]'.

Occupational Health Management Structures

10.8. During the First Deseal/Reseal Program, occupational health was the responsibility of the RAAF Base Amberley Senior Medical Officer. The Ground Safety Manual identified Occupational Health as one of the subdivisions of the RAAF Environmental Health Program. At the time, the term Environmental Health was used to describe those health services primarily directed towards promotion and maintenance of optimum medical fitness and health, including the prevention of disease and injury. Essential to this concept was a range of measures designed by the World Health Organisation concerned with the control of occupational disease. The aim of this process was to promote 'the highest degree of physical, mental and social wellbeing of workers in all occupations and the adaptation of work to man and of each of man to his job'[8].

10.9. The Occupational Health Program was designed to manage occupational health through the following measures:

a. Pre-employment and periodic medical examinations,
b. Control and monitoring of working environment,
c. Recognition and evaluation of chemical and physical hazards, and
d. Medical aspects of ground safety.

10.10. The occupational health program was mainly concerned with the effects of chemicals and physical hazards on the human body[9]. The Manual specifically placed the responsibility for the recognition, evaluation, control and monitoring of chemical and physical hazards upon the Senior Medical Officer RAAF Base Amberley. Control and monitoring of the work

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7 WIT.0404.001, Witness Statement L M Nowlan at par 23
8 PUB.015A.001, World Health Organisation Definition of Occupational Health: RAAF Manual of Ground Safety General Information, Chapter 4 Section 1at par 1-4-1.
9 PUB.015A.001, World Health Organisation Definition of Occupational Health: RAAF Manual of Ground Safety General Information Chapter 4 Section 1 at page 1-4-2 par 404.

environment and the causes of occupational disease was also the responsibility of the Senior Medical Officer. In particular the provisions of DI (AF) PERS 56.6-6 identified that Medical Officers and hygiene personnel were routinely to inspect the working environment. In performing this task the Manual provided that medical personnel were to be guided by the following three concepts:

a. Recognition of the hazard, which requires knowledge of the work operations and processes and the use of potentially toxic substances;
b. Evaluation of the health risk of the process through judgement and experience. A decision equally involving management of the level of the hazard by qualified staff and the determination of the degree of contamination or emissions and comparing the results with the threshold limit values, approved standards, and the permissible levels prescribed in Annex A; and
c. Making valid recommendations for the control of the hazard by isolation, substitution, changing the process, substitution of methods, local exhaust ventilation, personal protective equipment, training and health education[10].

10.11. Implicit in this duty was the need for medical personnel to be appropriately trained to carry out the functions.

Industrial Process relevant to Deseal/Reseal

10.12. The Manual also contained a list of RAAF occupations and identified the industrial process, a summary of the hazards, the possible effects on humans and a summary of the control measures with respect to the potential hazard. The medical personnel were required to be aware of the industrial processes that were conducted at that particular unit and of the effects of the hazard on humans and control matters relevant to those industrial processes. The industrial processes relevant to the 3AD Deseal/Reseal Section were aircraft maintenance and fuel tank repairs. Set out hereunder in Table 11.1 are the requirements in respect of each industrial process:

Table 10.1 Requirements in Respect of Each Industrial Process

Industrial Process	Hazard Summary	Possible Effects on Humans	Summary of Control Measures
Aircraft Maintenance	Solvents, Detergents, Chemicals, Toluene, Acetone, MEK	Dermatitis	General exhaust or ventilation, respirators and protective clothing.
Fuel Tank Repairs	Desealing Compounds, MEK, Naphtha, Sealants, Protective Coatings, Heat	Dermatitis, asphyxiation, lung and eye irritations, fatigue	Exhaust ventilation, supplied air respirators, protective clothing [11]

Training

10.13. In respect of safety procedure training, the Manual specifically identified that:

> ‘ the ability to recognise conditions or circumstances which are likely to lead to occurrences of an accident is an intuitive or inherent ability … is an ability enriched by experience and training.’

10.14. Supervisors were to be provided with formal training in safety. This training consisted of a basic overview of the procedures for determining accident causes and remedies. The

10 PUB.015A.001, World Health Organisation Definition of Occupational Health: RAAF Manual of Ground Safety General Information Chapter 4 Section 1 at page 1-4-2 par 408.

11 PUB.015A.001, World Health Organisation Definition of Occupational Health: RAAF Manual of Ground Safety General Information DI (AF) AAP6700.001 Chapter 4 Section 1 at page 1-4b-1, 1-4b-4.

training was of a general nature and did not provide the supervisor with specific safety instructions relevant to the individuals actual tasks. Therefore, it was the responsibility of the superior to convert safety guidelines, supplemented with their experience, into everyday safe practise procedures. These safety procedures were to be passed on to the subordinates by on-the-job training.

10.15. The training of personnel on the first Deseal/Reseal program was competency based and accordingly was provided by supervisors or more experienced members as on-the-job training[12]. The evidence is that training was dependent upon the work being undertaken. This included training on the safety precautions associated with all phases of the Deseal/ Reseal program described as an induction course)[13].

10.16. Some witnesses provided valuable insight into the type of training that was received in relation Deseal/Reseal:

a. 'I completed an F111 Ground Handling Course at 482 Wing, Amberley in April 1987[14]'.
b. 'The only instruction, which I received, was informal on the job training provided by Junior NCO supervisors and my work colleagues…..I cannot recall any OH&S instructions. I believe that it is unlikely that there were any instructions as Occupational Health and Safety was not really a well accepted concept in the early 1980s in the RAAF'[15]
c. I do not recall there being any policy or formal procedures in place insofar as Occupational Health and Safety was concerned.
d. 'We did not receive any formal training or instruction about health and safety issues as they related to the Deseal/Reseal Program although we had already received some training through our trade courses. However, we did receive informal, on the job instruction about some health and safety issues. We were told to wear the Personal Protection Equipment so as to avoid contact with the chemicals and also to avoid physical injury.'[16]
e. 'The term OH&S did not even exist at that time. There was no concern at all in respect of health or safety issues. I do not recall any training, formal or informal about these issues.'[17]
f. 'We did not complete any Confined Space Entry course and there was not any information about the chemicals and their effects made available to us.'[18]

10.17. The safety-training regime for supervisors existed as formal training. It was the duty of the supervisor to convert his or her training and experience into practical on-the-job training for members. To discharge this duty the Manual detailed that the supervisors must have adequate training and knowledge in the following areas:

a. Accident causation;
b. The recognition of hazards and how to eliminate them;
c. How to investigate an accident and how to analyse the factors which contribute to it;
d. How to instruct men in safe working methods, and
e. How to react and maintain the interest of men in their personal safety.

10.18. The Manual did not identify specifically, how this was to be achieved[19].

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12 WIT.0202.001, Witness Statement of A W Mott at pars 13-17; WIT.0081.001, Witness Statement of M L Duckworth at pars 8 and 9; WIT.0242.001, Witness Statement of D W B Rigden at pars 6-10.
13 WIT.0242.001, Witness Statement of D W B Rigden at pars 12-14. WIT.0271.001, Witness Statement of J R Sargeant at pars 14(ii), 15, 20, 23-24; WIT.0098.001, Witness Statement of D R Doggett.
14 WIT.0020.001, Witness Statement P F Barrett at par 25
15 WIT.0091.001, Witness Statement of L A Fatt at pars 12 & 15.
16 WIT.0042.001, Witness Statement of I C Breed at pars 28-29.
17 WIT.0064.001 , Witness Statement of G M Curl. at par 13.
18 WIT.0064.001 , Witness Statement of G M Curl. at par 19.

Hazard Identification and Risk Assessment

10.19. With regard to OH&S Assessment/ Inspection/Monitoring, Witness Statements report the following:

a. ‘There were no OH&S approvals required in relation to the Program. As far as I am aware, there were no monitoring procedures in place nor was anyone appointed to monitor OH&S standards.’[20]

b. ‘I do not recall there being any monitoring of Occupational Health and Safety standards.’[21]

c. ‘I do not know whether anyone was monitoring health and safety standards, if there were, any standards set then I assume that they should have been monitored by Environmental Health Section. I did not see anyone monitoring standards’.[22]

SECOND DESEAL/RESEAL

Hawker de Havilland OH&S System

10.20. As part of the tendering process Hawker de Havilland was required to demonstrate its ability, to comply with quality control and Occupational Health and Safety. The RAAF accepted a representation as to the ability of Hawker de Havilland to so comply.

10.21. The Hawker de Havilland Quality Assurance structure included components on health and safety. Sections of the Hawker de Havilland CMIs that were relevant to OH&S were as follows:

a. Part 3 Training - 3.1 Training Plan; 3.2 Technical Training; and 3.3 First Aid training,

b. Part 5 Fire, Security, First Aid, Emergency Callout Procedures and Worker's Compensation - 5.1 Fire Procedures; 5.2 Security Procedures; 5.3 First Aid Procedures; 5.4 Emergency Callout Procedures; and 5.5 Workers' Compensation,

c. Part 7 Safety - 7.1 Working with Flammable and Toxic Substances; 7.2 Foreign Object Damage Control Plan; 7.3 Fire Prevention; 7.5 Composite Tool Boards; 7.6 Mains Operated GSE; 7.7 Storage of Fluids Used in Technical Maintenance; and 7.8 Surface Finishing, 7.4 Fuel Tank Maintenance Entry Safety Procedures. This outlined the safety precaution policy of tank entry - recognised as a hazardous operation. AAP 292-3 was cited as containing a comprehensive description of fuel tank hazards. The Hawker de Havilland Amberley procedures were based on this and AAP 7214.003-2-8-1 Section 10 Purging[23], but were ‘improved and modified … to reflect civilian requirements’. The CMI included the requirement for fuel tank entry certificates and atmospheric monitoring. The Quality Controller was responsible for filing completed certificates[24].

d. Part 9 Industrial Health and Hygiene[25] 9.1 Industrial Health and Hygiene discussed hazardous substances and provided for a toxic substance register. It also defined policies for PPE and, respiratory protection[26].

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19 PUB.015A.001DI(AF) AAP6700.001, RAAF Manual of Ground Safety General Information; 02 Feb 97 at pages 1-6-6 pars 115-116.
20 WIT.0091.001, Witness Statement of L A Fatt at par 17.
21 WIT.0042.001, Witness Statement of I C Breed at par 31.
22 WIT.0064.001, Witness Statement of G M Curl at pars 15-16.
23 AMB.0008.132, T.O. F-111C-2-8-1 Section X – Purging.
24 HDH.0016.027 (at 092), Fuel Tank Maintenance Entry Safety Procedures.
25 HDH.0016.027, (at 031), Contractor Maintenance Instructions Distribution List; 02 Jun 92.
26 HDH.0016.027, (at 137), Industrial Health and Hygiene.

OH&S Activities Conducted

10.22. Safety Meetings. Safety/Foreign Objects Damage (FOD) Committee Meetings were held frequently. Based on the minutes available there were usually at least two per month in 1991 and early 1992, reducing to monthly from mid-1992. At these meetings management and workplace representatives discussed issues of concern. Topics of interest, relating to chemical exposure, included:

a. MRL OHS advice on sealants and solvents[27],
b. Dr Tankey advice on First Aid[28],
c. HAZCHEM warnings and safety signs occupied quite some time[29].
d. Goggles[30],
e. Adequacy of cartridge respirators. Shift supervisors were tasked to ensure employees wear breathing air apparatus[31]. New facemasks were trialed at the end of 1991 and training in respirator maintenance was investigated[32]. A comprehensive report on the trial of various respiratory protection devices was provided at an extraordinary meeting of 10 Feb 92[33]. Results of the trials were quickly implemented[34].

10.23. Monthly communication meetings for all personnel were used as a management tool to enable communication between management and staff. They were used to address performance issues, objectives and any concerns or complaints[35]. The agenda for these meetings indicate that management wished to discuss OH&S issues (such as PPE, respiratory protection, eye protection, clothing etc), safe work practices and hazardous chemicals. As it appears that Minutes were not always taken of the meetings, there are gaps in the documentary evidence of the discussions and the results of these meetings. For example, chemicals and respiratory protection were to be discussed in June 1992,[36] but no record (minutes or notes) of the actual discussions has been discovered to date. It is noted that the agenda for the May 1991 meeting included Respiratory Protection Devices[37] but no mention of that topic was made in the minutes[38].

10.24. The following was said of safety meetings during this period:

> 'I attended shift meetings when I was told what tasks were to be carried out. On these occasions if a particular safety problem had occurred, (eg someone had been hit with the hydrolaser, or had been fooling around with the Mil-Spec), then those matters would be discussed and the safety procedures reinforced. The supervisors on the shop floor would

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27 HDH.0012.199, Minutes of DSRS Safety/FOD Meeting; 23 Apr 91.
28 HDH.0012.185, Minutes of DSRS Safety/FOD Meeting; 01 May 91.
29 HDH.0012.185, Minutes of DSRS Safety/FOD Meeting of 01 May 91, HDH.0012.181, Minutes of DSRS Safety/FOD Meeting; 22 May 91, HDH.0012.178 Minutes of DSRS Safety/FOD Meeting; 05 Jun 91, HDH.0012.174, Minutes of DSRS Safety/FOD Meeting; 15 Aug 91, HDH.0012.181 Minutes of DSRS Safety/FOD Meeting; 22 Aug 91, HDH.0012.170 Minutes of DSRS Safety/FOD Meeting; 06 Sep 91.
30 HDH.0012.181, Minutes of DSRS Safety/FOD Meeting; 22 May 91, HDH.0012.178Minutes of DSRS Safety/FOD Meeting; 05 Jun 91, HDH.0012.117 Minutes of DSRS Safety/FOD Meeting; 23 Jul 92, HDH.0012.114, Minutes of DSRS Safety/FOD Meeting; 22 Aug 92.
31 HDH.0012.174, Minutes of DSRS Safety/FOD Meeting; 15 Aug 91, HDH.0012.134 Minutes of DSRS Safety/FOD Meeting; 13 Dec 91, HDH.0012.132 Minutes of DSRS Safety/FOD Meeting; 29 Jan 92.
32 HDH.0012.149, Minutes of DSRS Safety/FOD Meeting; 26 Nov 91, HDH.0012.141 Minutes of DSRS Safety/FOD Meeting; 03 Dec 91, HDH.0012.132Minutes of DSRS Safety/FOD Meeting; 29 Jan 92, HDH.0012.125, Minutes of DSRS Safety/FOD Meeting; 10 Feb 92.
33 HDH.0012.125, Extraordinary Meeting of DSRS Safety/FOD Meeting; 10 Feb 92.
34 HDH.0012.119, Minutes of DSRS Safety/FOD Meeting; 17 Feb 92 and HDH.0012.130, Minutes of DSRS Safety/FOD Meeting; 04 Mar 92.
35 HDH.0009.250, Monthly Communications Meetings from N Conn; 25 Feb 91. See also the WIT.0515.001, Witness Statement of Barry Thomas McGrath (Manager Support Services) at par 6.
36 HDH.0009.223, Notice of Communications Meeting June 1992; 01 Jun 92.
37 HDH.0009.242, Notice of Communications Meeting May 91; 1 May 91.
38 HDH.0009.241, Communications Meeting; 03 May 91.

discuss safety issues at these meetings. I recall that we had two or three meetings in the amenities block and all staff attended.'[39]

Hawker de Havilland Training Requirements

10.25. The HDH requirements for training are addressed in the Contractor Maintenance Instructions:

a. CMI 3.1 provides that the Manager Support Services is the Training Co-ordinator and specified that, among other courses, an F111 Deseal/Reseal Operators' Course was to be conducted,

b. CMI 3.1 provided that on-the-job training was to be conducted by the Quality Controllers or qualified tradesman/specialists in the areas of safety and industrial and personal hygiene[40],

c. CMI 7.4 provided for Fuel Tank Maintenance Entry Safety Procedures and directed that training requirements be applied as contained in DI (AF) AAP 7214.003-292-3[41].

10.26. A detailed syllabus for the Deseal/Reseal Operators Course conducted by Hawker de Havilland prior to February 1992 has not been identified. However, course certificates for courses conducted before this included an outline of the course content. The certificates indicate that the training included the Deseal/Reseal process and sealants.

10.27. After February 1992 there is extensive documentation regarding the Deseal/Reseal operators course as designed by Hugh Betteridge[42]. Hugh Betteridge was tasked by Hawker de Havilland to prepare a syllabus for and to conduct a five-day course on aircraft familiarisation and the Deseal/Reseal process for new employees. He described the course content as including:

> ' … the Deseal/Reseal process, the materials that would be used during the process and all safety aspects including the handling of chemicals, the required Personnel Protective Equipment and general safety around the aircraft.[43]'

10.28. In addition to the Deseal/Reseal operators courses, the Hawker de Havilland training structure included the following training:

a. Continuation and on the job training. OJT was required by CMI 7.4 as described above. Examples included:

(1). a staff briefing by an MRL representative concerning chemicals[44];

(2). staff training concerning PPE from suppliers including Protector Safety Pty Ltd and Norton[45]; and

(3). briefings regarding chemicals and PPE at communications meetings[46].

10.29. Documents indicate an attempt to formally record continuation training and OJT on personal files[47].

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39 WIT.0060.001, Witness Statement of D N Godfrey at par 31.
40 HDH.0016.027 (at 049).
41 HDH.0016.027 (at 093).
42 See for example, WIT.0025.001, Witness Statement of Hugh Charles Betteridge; 08 Dec 00 at pars 2-10. Also: HDH.0014.012, HdH Internal Memo; 17 Feb 92.
43 WIT.0025.001, Witness Statement of Hugh Charles Betteridge; 08 Dec 00 at par 32.
44 WIT.0516.001, Witness Statement of Maurice Saywell (Sealant Controller) at par 24.
45 WIT.0516.001,Witness Statement of Maurice Saywell (Sealant Controller) at par 25
46 WIT.0515.001, Witness Statement of Barry Thomas McGrath at par 24.
47 HDH.0009.067, HdH Memo from Support Services Manager to DSRS Operations Manager; 13 Apr 92. HDH.0009.086, HdH Internal Memo form DSRS Quality Controller to Training Coordinator; 02 Oct 91.

OH&S-Related Specialist Training.

10.30. OH&S Activities Conducted. Documents and witness statements generally indicate a positive, structured approach to occupational health and safety. As with all the DR programs, hazards with obvious, acute physical effects such as waterpicking and the explosive potential of fuel vapour were particularly well dealt with in the Second Deseal/Reseal Program.

10.31. The Hawker de Havilland training program included OH&S-Related Specialist Training. Personnel responsible for OH&S attended external training courses including the Workplace Health and Safety Officer Courses at TAFE. It is reported that these courses included Commonwealth OH&S legislation, safety inspections, and MSDS knowledge[48].

Hazardous Substance Training

10.32. Many of the chemicals used in the Second Deseal/Reseal program contained hazardous substances. A key component of hazardous substance training is to provide an understanding of the hazards posed by the chemicals and the appropriate PPE to be used. This is primarily achieved through personnel understanding the components and implications of the Material Safety Data Sheets that were required, under Australian Standards, to accompany the delivery of each chemical.

10.33. As noted above, continuation and on-the-job training was either conducted on an as required basis or through the regular staff meetings which addressed chemicals amongst other issues. Nevertheless, there was some formal hazardous substance training for personnel employed on the Second Deseal/Reseal Program. The syllabus for the course developed by Hugh Betteridge did include instruction on chemicals in the Deseal/Reseal process. The syllabus included the following:

> ' … solvent cleaner MIL-C-38736 (MEK), it's properties and use, precautions during use and PPE during use; Alodine, it's properties and use, precautions during use and PPE during use; and, 'know the types of sealants and barrier used during the F-111 Deseal/Reseal program.[49]'

10.34. It is noted that the syllabus for the Operators' Familiarisation Course did not specifically refer to MSDS's as a topic. Regarding the dissemination of the content of MSDS's, CMI 9.1 provides for a toxic substances register (TSR) containing hazardous analysis data. The purpose of the TSR was to ensure personnel were aware of the hazard and the required PPE. The Quality Control Section was responsible for the maintenance of the TSR. [50] Statements indicate that MSDS's were kept in the TSR and were available in a number of office locations[51].

10.35. While some witness statements generally indicate there was some form of chemical awareness training conducted, either formal or informal, with MSDS's being generally accessible[52].

Second Deseal/Reseal Process Training

10.36. A Deseal/Reseal operator's course was conducted that included information concerning the Deseal/Reseal process. Apart from formal courses, there was informal on-the-job training conducted during the Second Deseal/Reseal Program[53].

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48 WIT.0515.001, Statement of Barry Thomas McGrath (Manager Support Services) at par 28.
49 WIT.0025.001, Witness Statement of Hugh Charles Betteridge (at enclosure).
50 HDH.0016.027 (at 138), CMI 9.1 at pars 7-8.
51 WIT.0516.001, Witness Statement of Maurice Saywell (Sealant Controller) at pars 23 and 34. WIT.0515.001, Witness Statement of Barry Thomas McGrath (Manager Support Services) at par 14.
52 WIT.0011.001, Witness Statement of Roger Paul Amiss; 11 Dec 00 at pars 9 and 40. WIT.0012.001, Witness Statement of Ricky James Barrett; 11 Dec 00 at par 9. WIT.0025.001, Witness Statement of Hugh Charles Betteridge; 08 Dec 00 at par 32. WIT.0070.001, Witness Statement of John Nicholas Collinson; 06 Dec 00 at par 39.

10.37. A witness reported that Hawker de Havilland did not provide him with any training[54]. This statement reflects the fact that a number of former RAAF technicians were employed by Hawker de Havilland. There is evidence that Hawker de Havilland had a structured training program and that the program was widely implemented.

Confined Space Entry Training

10.38. Hazards associated with work in confined spaces can cause fatal or debilitating accidents. Hazards that may have been encountered during Deseal/Reseal operations included:

a. release of harmful gases or liquids into the confined space,
b. high ambient temperatures,
c. exposure to asphyxiating, toxic, corrosive, or flammable substances, and
d. insufficient oxygen to maintain life[55].

10.39. Hawker de Havilland Training Requirements. CMI 7.4 provided that training concerning fuel tank entry was to be in accordance with AAP 7214.003-292-3 and provided for a system of fuel tank entry certification[56].

10.40. AAP 7214.003-292-3 specified that the safety precautions and hazards are checked and recorded on an entry permit before members were allowed to enter the fuel tank. The 292-3 entry permit contained the following information:

a. 'location and description of the work to be carried out;
b. hazards that may be encountered;
c. worksite and fuel tank preparation;
d. atmospheric test results (LELs);
e. duration of validity, taking into account the likelihood of the temperature rising;
f. identification of the stand-by-person; personal protective equipment and clothing required;
g. chemicals permitted in the fuel tank; and
h. safety precautions required.[57]'

10.41. There is documentary and witness evidence indicating that Hawker de Havilland conducted confined space entry training as part of the induction course[58].

Personal Protective Equipment

10.42. The evidence indicates that Hawker de Havilland management created a formal structure that compelled the wearing of prescribed PPE, advertised its requirements and provided for remedial/disciplinary action for non-compliance. The following should be noted:

a. Posters were placed in the work environment detailing what PPE was required for particular chemicals/tasks[59],

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53 See for example: WIT.0012.001, Witness Statement of Ricky James Barrett, 11 Dec 00 at par 9.
54 WIT.0416.001, Witness Statement of William Andrews at par 19.
55 OHSMAN1 Chapter 20 at par 2001.
56 HDH.0016.027, (at 093), CMI 7.4 at pars 7-10.
57 PUB.0004.001, AAP 7214.003-292-3 Deseal/Reseal of F111C Fuselage Fuel Tanks Health and Environment Quality Control and Equipment Operating Instructions; 13 Sep 90.
58 WIT.0515.001, Witness Statement of Barry Thomas McGrath (Manager Support Services) at par 14a. See also the syllabus which addresses fuel tank entry certificate enclosed with the WIT.0025.001, Witness Statement of Hugh Charles Betteridge and the Course Content document enclosed with the Completion Certificate for the HdH DSRS Operators Course which includes provision for 'Entry Into Tanks' Annex B to Manager Support Services Minute; 06 Apr 92.
59 MAN.0105.001Witness Statement of Michael Gleeson (Facility Manager) at par 92. Examples of Posters are at HDH.0014.209 to 214.

b. Hawker de Havilland, Victoria promulgated to staff a notice concerning the Wearing of Safety Equipment. It stated that it 'is a condition of your employment, effective immediately, that personnel who do not wear appropriate, company supplied, protective equipment…as deemed necessary to safely perform the work activity will be subject to disciplinary action.[60] This Notice was forwarded to Hawker de Havilland management officers at Amberley under cover of an Internal Memorandum from the Manager, Aircraft Support. It supported the Notice and directed that 'All personnel are to be briefed on this requirement, the responsibility for compliance being upon the individual. However, it is the responsibility of management (monthly staff, supervisors and leading hands) to ensure we have the most productively effective and safe working environment …[61]',

c. There is evidence of remedial/disciplinary action including dismissal and counselling sessions being taken for breaches of safety, although it is uncertain whether this specifically related to the wearing of PPE[62],

d. Liaison with Protector Safety Pty Ltd and others was carried out to ensure the PPE was serviceable and effective[63],

e. CMI 7.4 provided that, Leading Hands were responsible for ensuring that 'safety procedures and equipment as specified in this CMI and directed by the Shift Supervisor or Leading Hand are fully implemented/utilised.' CMI 7.4 provided at Annex A a list of currently authorised PPE[64], and

f. The Fuel Tank Entry Certification, that was to be signed by the Supervisor/Leading Hand and operators, contained a Warning regarding the wearing of PPE and specified the PPE to be worn[65].

Defence Regulatory Requirements

10.43. The OHSMAN aimed at ensuring that Defence managers adopted the OH&S Audit Program guides and implemented a regular OH&S Audit Program[66]. It is of note, that the OHSMAN was not a prescribed document in the Standing Offer.

10.44. Clause 7.1 of the Standing Offer provided that the Contractor shall institute and maintain a Quality Control System in accordance with the requirements of Annex C thereto[67]. Annex C included the following:

> 'that the Contractor shall be responsible for the provision of Objective Evidence that controls and inspections are effective; that the Contractor shall perform or have performed all examinations and tests prescribed in maintenance documents; and, that the Contractor shall keep and maintain proper and adequate inspection, test and related records.[68]'

10.45. Hawker de Havilland System ISO 9001:1987, known also as AS 3901:1987, concerning quality systems for design/development, production, installation and servicing[69],

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60 HDH.0012.031, Notice signed by Manager Manufacturing Operations; 26 Feb 91.
61 HDH.0012.028, Hawker de Havilland Internal Memorandum; 14 Mar 91.
62 WIT.0515.001, Witness Statement of Barry Thomas McGrath (Manager Support Services) at par 51.
63 HDH.0012.211, See for example, HdH letter to Protector Safety Pty Ltd regarding a Chemical Hood Respirator.
64 HDH.0016.027 (at 092 and 093), CMI 7.4 at pars 5 and 6 and Annex A.
65 HDH.0006.001, Annex to CMI 7.4
66 OH&S, chapter 27 at para 2713(f).
67 AMB.0091.186 (at 192), Standing Offer Acceptance No PV8440 - F111 Aircraft Fuselage Fuel Tank Deseal/Reseal Programme for RAAF for Period 19 Oct 90 to 31 Oct 93; 4 Dec 90 and AMB.0091.176, Standing Offer Acceptance No PV8440 Quality Control and Quality Assurance Requirements – General Requirements - Contractor Requirements; 4 Dec 90.
68 AMB.0091.176, Contract Conditions, Quality Control and Quality Assurance Requirements; 4 Dec 90.
69 The Australian version was renamed to AS 9001 when it was updated in 1994.

describes standards of quality assurance. Hawker de Havilland documentation, as reflected in its Product Assurance Manual - PAM 2, is based on this system. PAM 2 Section 5.17 describes the system of audits to be conducted by Hawker de Havilland. There is a requirement for an audit plan to be developed by management.

10.46. Within the framework of PAM 2, Hawker de Havilland's Quality Program Plan QP 101 or QPP 101described the Quality Assurance system to be applied to the DSRS. QPP 101 was written to comply with AS 3902: 1987 quality systems for production, installation and servicing[70]. Topics covered included: quality audit/surveillance; quality planning; production management; traceability; non-conformance; certification; safety and material control. Various other Quality Procedures covered generic practices throughout the organisation, such as, inspections, reviews, training, purchasing, FOD and corrective actions.

10.47. CMIs are the third and next level of relevant Hawker de Havilland policy. They are workplace-specific documents that define functions at DSRS Amberley. They were issued in accordance with the Standing Offer and with the intent of being consistent with DI (AF) TECH 25-11 Supervision and Inspection of Technical Maintenance Operations and 3AD maintenance instructions[71].

10.48. Quality Control in Practice. The positions of Quality Controllers at Hawker de Havilland's facility at Amberley were filled by G. Murdoch[72], Peter Fortune[73], and later Maurie Saywell[74].

10.49. There were scheduled and unscheduled audits conducted as part of the quality control program. The scheduled audits were based on a systematic checklist. Any Corrective Action Requests (CAR's), which were issued as a result of some anomaly, appear to have been followed up in later audits.

10.50. QP 9 and CMI 10 provided for the issuing of CAR's and Snag Sheets, Snag Sheets being raised to correct minor non-conforming procedures.[75] CARs were a formal system requiring corrective action as well as prescribing preventative measures to eliminate any non-conformance or non-compliance[76]. CAR's were focused on improving housekeeping and documentation tracing processes or equipment (eg worksheet signatures, unserviceability tags, servicing cards) and touched upon occupational health and safety issues. With regard to OH&S in the Second Deseal/Reseal Program, it appears that the liability and indemnity clause contained in the Standing Offer was relied upon to replace the Commonwealth's responsibility for OH&S and to place the liability upon the contractor. HDH were bound by OH&S legislation and other relevant legislation such as the *Workers Compensation Act* 1916 – 1980 (Q)[77].

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70 ISO 9001, 9002 and 9003 (AS 3902, 3902 and 3903) were all concerned with quality systems, with minor variations according to the products and services of the organisation. 3901 included design processes and 3903 included inspection and testing.

71 HDH.0016.027 (at 031) Contractor Maintenance Instructions Distribution List; 02 Jun 92.

72 See for example: HDH.0007.154, Internal Memo DSRS Quality Program Plan QP101; 23 Apr 91.

73 See for example: HDH.0007.151. Internal Memo Safety Committee Meeting; 19 Apr 91.

74 See for example HDH.0014.001 Internal Memo Scheduled Internal Quality Audit and WIT.0516.001, Witness Statement of Maurice Saywell (Equipment Controller) at par 1.

75 WIT.0516.001, Witness Statement of Maurice Saywell (Sealant Controller) at par 28.

76 HDH.0016.027 (at 147) CMI 10.1 Corrective Action System.

77 HDH.0016.027 (at 069), CMI5.5 *Workers Compensation Act* 1916-1988 HdH obligations.

WING DESEAL/RESEAL

10.51. The Wing Deseal/Reseal Program was conducted from the period of 1986 to the period of 1992. The Safety Management System was similar to that of the First Program. The OH&S Act not coming into operation until 1991.

10.52. Documentation reveals that on 22 June 1987 a report was received by Headquarters RAAF Base Amberley from the Amberley Base Ground Safety Committee Meeting convened on 19th May 1987. It appears that this committee was newly formed. At that time, the new Ground Safety Policy was implemented and the committee was advised that there was a new policy in place with respect to all Commonwealth employees (whether military or civilian) regarding OH&S.

10.53. The policy regarding OH&S reflected what was to be implemented pending legislation. The need to ensure civilian representation on RAAF Ground Safety Committees was the subject of some agitation yet can be seen as a significant breakthrough in the implementation of new OH&S ideology. The Base Ground Safety Committee Meeting of 19 May 1987 reviewed the need to ensure civilian representatives on Occupational Health & Safety Committees and also the pending legislative requirements with respect to OH&S. The Occupational Health & Safety legislation was implemented within Defence by DI (G) PERS 19-2 [DI (AF) PERS 60-1].

10.54. 3AD (and then 501 WG) during the course of the Wing Deseal/Reseal Program was pro-active in the formation of Occupational Health & Safety Management Committees[78].

10.55. The evidence suggests that there was a lack of suitably qualified personnel or personnel prepared to adopt the role of full-time safety officers[79]. The correspondence and Minutes of Meetings made it apparent that the ongoing problem with respect to risk management, policy formulation and implementation emanated from the lack of resources necessary to implement the policies and also, the resources necessary to keep up to date with current trends in Occupational Health & Safety[80].

10.56. The evidence suggests some difficulty in reading the policies due to the reported voluminous nature of the policies presented problems[81] This difficulty was overcome by individual attempts to ensure personnel were aware of their existence by briefings before the commencement of shifts. One member recalls 'prior to commencing our involvement in the deseal of the tanks, we have been provided by a demonstration by an NCO from the Wing Deseal/Reseal Program. This demonstration and brief related to the use of the hydrolaser and safety aspects associated with it. There was no refresher training [82]. The witness goes on to state 'It was my belief that safety was supervised and enforced. Overall the section was aware of the risks and was overly cautious in using the chemicals and the equipment. It was as if no chances were being taken [83].

Hazard Identification and Risk Assessment

10.57. The evidence of audit and assessment of OH&S during the Wings Program is:

a. 'As far as I can recall no one was designated within the section to monitor Occupational Health and Safety standards and procedures.'[84]

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78 AMB.0078.101, Formation of the RAAF Amberley Occupational Health and Ground Safety (OG&Gs) Management Committee.
79 MAN.0113.001, Witness Statement of William Brett Wood; at pars 17 & 18.
80 MAN.0113.001, Witness Statement of William Brett Wood;at par 25.
81 MAN.0113.001, Witness Statement of William Brett Wood; at pars 26 & 27.
82 WIT.0272.001, Witness Statement of TJ Saville; at par 8
83 WIT.0272.001, Witness Statement of TJ Saville; at par 17
84 WIT.0035.001, Witness Statement of D A Balassa at par 11.

b. 'I am not aware if there was any monitoring program for OH&S standards and if so by whom it was conducted.'[85]

Training

10.58. The evidence of training during the Wings Program is:

a. 'Any instructions that were given on how the job was done were very informal. I did not receive any further instructions and orders on tank entries or on carrying out my duties at the Deseal/Reseal Section.' [86]

b. 'Training was on the job. I was given instruction in how to perform the various tasks by more experienced LACs and Corporals. I did not complete a Confined Tank Entry Course. I did not complete a Hazardous Chemical Management Course.'[87]

c. 'I remember the training was on the job training from supervisors and peers. I had no formal tank entry training until Sergeant Sandham and myself went to a course at RAAF Laverton, where we completed a Workplace Assessor's Course, sponsored by Goulburn Murray Water. This was in July 1995 not long before I left the section. What we were trying to do was formalise tank entry, with accreditation, and after completing this course we initiated a Tank Entry Course at Amberley. At Laverton, we completed a two-day Confined Spaces Course, followed by a two day Confined Spaces Entry Assessment Course.'[88]

d. 'I received no formal Occupational Health and Safety (OH&S) training while at DRS or FTRS. From memory, it was supposed to be mandatory for everyone in the RAAF to do an OH&S course, but I cannot remember one and nothing of this kind is reflected in my Record of Tasks and Employment (RTE).'[89]

e. 'The only training received apart from 482 Squadron Field Training Flight F111 Aircraft Courses that I can recollect was from informal on the job training.'[90]

f. 'In so far as health monitoring was concerned I recall that six monthly medical checks covering blood and urine samples were performed but I can only recall this happening two or three times in my four year term at Deseal/Reseal section.'[91]

Committees/Safety Meetings during the Wings Program.

10.59. The evidence of committees/safety meetings is :

a. 'There were no briefings or meetings on Occupational Health and Safety.'[92]

Conversly:

b. 'We did have regular section meetings and it was at these meetings that troops would be singled out and be required to give a lecture on a topic like Personal Protective Equipment or how to mix sealant or something related in a practical way to the jobs we were undertaking at the time. As I recall we tried to have these meetings once a fortnight unless our workload prevented.'

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85 WIT.0162.001, Witness Statement of B N Ketchell at par 14.
86 WIT.0552.001,Witness Statement of M D Kehagias at par 17-18.
87 WIT.0519.001, Witness Statement of S A Podbury at par 16.
88 WIT.0029.001, Witness Statement of A M Bellott at par 12.
89 WIT.0029.001, Witness Statement of A M Bellott at par 20.
90 WIT.0035.001, Witness Statement of D A Balassa at par 9.
91 WIT.0035.001, Witness Statement of D A Balassa at par 33.
92 WIT.0552.001, Witness Statement of M D Kehagias at par 20.

Safety Appointments

10.60. The evidence of Safety Appointments during the Wings Program is:

a. 'I do not recall any safety officers supervising the work practices being done in that section at that time.'[93]

b. 'The Environmental Health Officer did not visit the Hangar when I was there.'[94]

c. Chemical Management during the Wings Program, witnesses report, in regard to chemical management, that:

d. 'I do not recall a chemical management system being in place whilst I was involved in the Deseal/Reseal Program.'[95]

GROUND SAFETY COMMITTEES DURING THE FIRST AND WING DESEAL-RESEAL PROGRAMS

Ground Safety Committees

10.61. The need to establish a Ground Safety Committee (GSC) was recognised as an important element of Workplace Health and Safety (as it then was) in section 2 chapter 1 of the Manual of Ground Safety[96]. Safety committees were set up as the management bodies through which the individual Commander directed and reviewed the implementation of accident prevention policies and systems. The Constitution of Safety Committees was considered to be the prerogative of the Commander. Sub-committees could be formed as required.

10.62. Evidence exists that Ground Safety Committee Meetings were held at Amberley involving 3AD during the First Deseal/Reseal Program. A review of the Minutes of these meetings has been conducted. One particular exhibit highlighted that on 19 March 1979 a Ground Safety Instructor attended meetings and participated in discussions with respect to the storage of SR51 at 3AD.

10.63. Furthermore, Storage of SR51 was seen to be of significant concern and it was the subject of ongoing Ground Safety Committee discussions and reflected again in Minutes of a Ground Safety Meeting, dated 11 June 1979[97].

10.64. Evidence exists that the Ground Safety sought to review such matters as, continuing First Aid Training and the implementation of a Safety Supervisors Course (the promotion of which appeared to be met with little enthusiasm). There was an action list for the Base Ground Safety Committee, which facilitated the tasking of some members of the Committee with functions that would ensure compliance with paragraph 109 of the Manual[98].

10.65. The Safety Committee appears to have attempted to arrange:

a. safety surveys on the Deseal Hangar,
b. safety courses for committee members,
c. annual safety surveys,
d. a review of hazards,

[93] WIT.0552.001 Witness Statement of M D Kehagias at par 21.
[94] WIT.0519.001, Witness Statement of S A Podbury at par 18.
[95] WIT.0091.001, Witness Statement of L A Fatt at par 30
[96] PUB.015A.001, RAAF Manual of Ground Safety – General Information; 08 Jan 79 at page pars 109.
[97] AMB.0077.052, Minutes of Base Ground Safety Committee Meeting held at Amberley; 04 Jun 79.
[98] AMB.0077.052, Minutes of Base Ground Safety Committee Meeting held at Amberley; 04 Jun 79, AMB.0077.045, Minutes of the Base Ground Safety Committee Meeting Held At Amberley on 04 Sep 79

e. a review of Incident Reports, and
f. a review of PPE together with a reporting of incidents of concern arising out of the inadequacy of PPE[99].

10.66. There is evidence of reporting to indicate compliance with the Manual of Ground Safety with regard to the establishment and function of the Ground Safety Committee at the commencement of and throughout the duration of the Deseal/Reseal Program[100].

10.67. Various matters came to the attention of the Ground Safety Committee such as the appropriateness of PPE and confined space entry. The Committee was effective in telecasting its concern and attempting to solve problems regarding the inadequacy of PPE particularly when used with certain chemicals. The effectiveness of the Committee is illustrated by its ability to ensure that personnel sections such as Environmental Health (EHS) were tasked to investigate inadequacies[101].

10.68. A review of ground incident reports raised in the previous period enables OH&S trends to be assessed. There were a number of accident prevention measures that were, at least on a policy basis, put in place even as far back as the 31st January 1980[102].

10.69. The RAAF Ground Safety Manual required the establishment of the Ground Safety Committee. Evidence exists indicating that the 3AD Ground Safety Committee met three monthly and considered such matters as:

a. a summary of hazards reports[103],
b. the progress of ground safety surveys[104],
c. any cases of personnel who had been exposed to an accumulated dose of ionising radiation exceeding 2/3 of the permissible quarterly level as shown in DI(AF)PERS 56-7[105],
d. any cases of chemical intoxication or poisoning[106],
e. any cases of hearing loss exceeding 15 decibels[107] in either ear at any frequency in a twelve month period,
f. a report of the Road Safety Sub Committee (CRSC),
g. the planning of local ground safety training[108],
h. the planning of formation safety programs,
i. business arising from previous minutes,
j. domestic electrical powered GSE,
k. disposal of waste and flammable liquids,
l. equipment problems,
m. parking/speeding issues,
n. PPE,
o. adequacy of facilities,
p. noise pollution,
q. summary of Hazard Reports, and
r. summary of Incident Reports.

10.70. An example of General business conducted by the Committee related to matters such as fire hazards, safety surveys, safety posters, dangers of traffic issues, equipment, storage

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99 AMB.0074.094,. Minutes of 3AD Ground Safety Committee Meeting Held at 3AD On 17 Jul 85
100 AMB.0079.108, Minutes of the 3AD Ground Safety Committee Meeting dated 22 Apr 80
AMB.0074.085, Minutes of 3AD ground Safety Committee Meeting dated 02 Oct 84
101 AMB.0074.099, Minutes Of 3AD Ground Safety Committee Meeting Held At 3AD On 28 Oct 85
102 AMB.0082.007, PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702a.
103 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7at par 702b.
104 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702c.
105 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702d.
106 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702e.
107 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702f.
107 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702g.
108 PUB.015B.001, DI(AF)AAP6700.003,section 2 chapter 7 at par 702h.
108 PUB.015B.001, DI(AF)AAP6700.003, section 2 chapter 7 at par 702i.

and toxicity of SR51, decisions and outcomes of training issues such as First Aid and Supervision. The conduct of the Ground Safety Committee meetings appeared to be consistent with the Ground Safety Manual. Moreover, specific consideration was given to aspects of the Deseal/Reseal process, notably: toxicity, storage and disposal of SR51. The specific hazards were not identified in the reports. There was reference to the chemical hazards contained within the report that was adopted and circulated after representatives of MRL had attended Eldorado Chemical Company in the United States of America and had observed the chemical Deseal/Reseal process taking place[109].

10.71. The evidence reveals that Ground Safety Committee meetings were frequently held, not only during the course of the First Deseal/Reseal Program, but also during the course of the Wing Deseal/Reseal Program[110].

10.72. Personnel conducting Deseal/Reseal in the First and/or Wing Programs have stated in relation to Ground Safety Committees 'on the 29th March 1990 I undertook a Ground Safety Course for Supervisors but apart from this there was no formal training in respect to my responsibilities as a supervisor' [111].

10.73. Evidence of the existence of the Ground Safety Committees is borne out by the evidence of one witness who states 'I am also aware that in 1988 I was part of the Ground Safety for Supervisors Course' [112]. Similarly, 'I can recall that we underwent a Ground Safety Course and Ground Handling Course. The Ground Safety Course was completed at Field Training Flight and was simply a general training course about familiarisation with the F111 aircraft, safety distances and hazards' [113]. Another states 'I also attended the F111 Ground Handling Course in July of 1993 and the F111 Fuel Cell ILM Course in October 1984 at Field Training Flight' [114]. One witness recalls back on the 30th April 1980, completing a formal Ground Safety Course for Supervisors' [115]. This witness recalls that this gave him a refresher relating to all aspects of safety relevant to that time in the workplace and considered the course to be of a general nature' [116].

SPRAY SEAL PROGRAM

10.74. The Spray Seal Program began in 1996 and continued until its suspension in January 2000. During this period the Safety Management System was formed by the Occupational Health and Safety Act (Commonwealth Employees) 1991. The Occupational Health and Safety (Commonwealth Employment) Act 1991 provides a statutory basis for the protection of the health and safety of Commonwealth employees at work[117]. The Act also imposes on the Commonwealth, as the employer, and its employees, a general duty of care and specific obligations concerning workplace health and safety[118].

10.75. The Defence Occupational Health and Safety Manual (DOHSMAN) and Chapter 27 of the Occupational Health and Safety Manual (OHSMAN) implemented the legislative requirements.The DOHSMAN is the authoritative source on Defence policy matters[119]. The Defence Occupational Health and Safety Manual (DOHSMAN) was first published in 1996.
It states that it is a fundamental element of leadership that managers and commanders look after the well being of their people, and to use an active approach to occupational health and safety. Specifically, it states that the Secretary and CDF will hold commanders and managers

109 EXP.0007.001, Witness Statement of Doctor Brenton Paul.
110 AMB.0074.082, Minutes of 3AD Ground Safety; 24 Oct 83. AMB.0074.103 – Minutes 17 February 1986 re Chemical Spill.
AMB.0074.104, – Minutes of 17 February 1986. Minutes of 3AD Ground Safety Committee on 05 Feb 86.
111 WIT.0292.001, Witness Statement of OR Zugno; at par 15
112 WIT.0296.001, Witness Statement of RJ Bissett; at par 23
113 WIT.0058.001, Witness Statement of JC Burridge; at par 13
114 WIT.0283.001, Witness Statement of NW Stallard; at par 12
115 WIT.0289.001, Witness Statement of G Small;
116 WIT.0289.001, Witness Statement of G Small; at par 31
117 DI (G) PERS 19-2, at par 1.
118 DOHSMAN, at page i, at par 1.
119 DI (G) PERS 19-18, at par 6.

responsible and accountable for the accidents and illnesses that occur in their workplaces[120]. DOHSMAN also states that commanders, managers, supervisors, and employees, at all levels, are responsible for implementing the policies contained in this manual[121].

OH&S Instructions

10.82. There were a number of Defence Instructions and Australian Air Publications, that inter-related to form the Safety Management System. These included:

10.83. DI (AF) Pers 60-1 (concerns the *OH&S Act*); DI (AF) Pers 60-7 (concerns health and ground safety audits); and, DI (AF) 60-10 (concerns matters such as the duties of environmental health personnel).

10.84. AAP 7214.003-292-3 Deseal/Reseal of F111C Fuselage Fuel Tanks Health and Environment Quality Control and Equipment Operating Instructions was the authoritative publication for detailing the OH&S requirements for the Deseal/Reseal process. The AAP 292-3, AL2 issued on 13 September 1990 but was not amended to address the OH&S requirements of the spray seal procedure. DI (AF) 7214.003-292-5, by default, became the authoritative document for occupational health and environment quality control and equipment operating instructions for spray seal. This document addresses matters such as the detailed procedures to be carried out and the PPE to be worn. AAP 7214.003-292-5 is very specific concerning the PPE to be worn by those conducting Spray Sealing itself, those mixing etc and other personnel working within 30 feet of the aircraft but not directly involved in Spray Sealing.

10.85. DI (G) PERS 19-8. The provision and use of PPE does not reduce or replace the need for proper hazard control measures, such as engineering or administrative controls, to be undertaken. In some instances, PPE may be necessary to supplement existing hazard control measures. Employees working in areas or performing processes where they are at risk of sustaining personal injury, illness, or damage to clothing are required to wear PPE when they are performing those functions.[122]

10.86. The DOHSMAN states that Commanders/Managers are to ensure that an assessment is made of the risks to health created by work involving potential exposure to hazardous substances. Commanders/Managers may need to seek the assistance of suitably trained Occupational Health and Safety (OHS) Officers/Advisers in the conduct of such an assessment.[123]

Environmental/OH&S Audits

10.87. DI (AF) PERS 60-7 states that:

a. 'Hazards may be detected through the normal day-to-day vigilance of personnel; however, that informal process must be supplemented by the more formalised processes of an occupational health and ground safety (OHGS) audit … Officers Commanding and Commanding Officers are to ensure that an OHGS audit of all ground work areas is conducted at least annually.[124]'

10.88. 'Program Managers are responsible for ensuring that all required regulatory and legislative provisions, relating to the management of hazardous substances, are being

120 DOHSMAN, page i.
121 DOHSMAN, page v.
122 DI(G) PERS 19-8, Personal Protective Equipment; 8 Apr 97 at pars 8, 9.
123 DOHSMAN, Annex A to Chapter 5 at par 17.
124 DI(AF) PERS 60-7 at pars 1 and 2. DI(AF) PERS 60-7, Occupational Health and Ground Safety Audits. Other References: DI(AF) PERS 60-1, OH&S (Commonwealth Employment) Act 1991 - Implementation within the ADF. DI(AF) PERS 60-3, Identification, Reporting and Control of Hazards Policy and Procedures. DI(AF) PERS 60-10, Air Force Environmental Management and Occupational Health and Safety Management Structure and Function.

implemented within their Programs. An internal monitoring system is to be established to enable an audit of such compliance[125].

10.89. In this regard, records and witness statement s indicate that only limited audits appear to have been conducted on the spray seal process. One witness indicated that one audit was limited to looking at procedure books and MSDS's[126]. Another witness described health and safety management as being 'pretty lax'[127], while another said 'OH&S weren't really interested and we were left to our own devices by everyone.[128]' WGCDR Ross comments that such audits were:

a. 'given a low priority … been allowed to lapse in many areas, in response to pressures for other tasks to be completed.[129]'

10.90. Further, GPCAPT Sargeant states:

10.91. OHS hazard audits (OSHMAN 27) had been carried out in many areas under OHSMAN 27 since before 1998. Whilst these have continued in Avionics and Engines, they may have lapsed at times within Aircraft Maintenance Flight, largely because of other pressing OHS issues.[130]

PPE

10.92. As set out by AAP 7214.003-292-5, those personnel involved in Spray Sealing are to wear:

a. an MSA whole body cooling system;
b. two Saranex 23P coveralls;
c. gloves Ansell/Edmont nitrile; and
d. a full-face air supplied respirator[131].

10.93. Those involved in mixing (and cleaning the guns/tips etc) are to wear the same PPE, except that the cooling suit is not required and the coverall may be polyethylene coated Tyvek instead of the Saranex[132].

10.94. Other personnel working within 30 feet of the aircraft (but not working directly with the Spray Sealing process and mixing the sealant, cleaning the gun/tips etc) shall wear:

a. a full-face cartridge respirator;
b. polylaminated Tyvek coverall with attached boots and drawstring hood; and
c. Nitrile gloves[133].

10.95. Witness statements indicate that prescribed PPE was not always worn. For example, AAP 7214.003-292-5 requires that those mixing the sealant and cleaning guns wear full-face air supplied respirators[134]. However, witness statements indicate that this was not complied with[135].

10.96. There appears to have been no detailed servicing plans or calibration schedule for the PPE and equipment used in the Spray Seal process nor the development of effective

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125 DOHSMAN, Annex A to Chapter 5 at par 41.
126 IOI.0001.262 (at 312 & .313), Investigating Officer interview of SGT Mills at question 119.
127 IOI.0001.057 (at 114), Investigating Officer interview of LAC Grant at question 190.
128 IOI.0001.151 (at 175), Investigating Officer interview of CPL Saunders at question 56.
129 EXP.0001.001, WGCDR Ross Report at page 49.
130 HRG.0001.001 (at 006), Statement of Richard James Sargeant at par 26
131 PUB.0005.001, AAP 7214.003-292-5; Spray Sealing of F111 Fuselage Fuel Tanks; 21 Jul 97 at par 6.
132 PUB.0005.001, AAP 7214.003-292-5; 21 Jul 97 at par 7.
133 PUB.0005.001, AAP 7214.003-292-5, 21 Jul 97 at par 8.
134 PUB.0005.001, (at 014) AAP 7214.003-292-5, 21 Jul 97 at par 7.
135 EXP.0001.001, WGCDR Ross Report, relying on statements of LAC Grant at page 23 and LAC Cotter at page 35.

maintenance procedures. Most safety equipment requires periodic servicing and maintenance is vital to ensure proper functioning. If there is a malfunction with the equipment due to inadequate servicing, this would be compounded due to the heavy reliance on PPE as a means to protect against possible exposure[136]. The absence of maintenance procedures could directly lead to the deterioration in effectiveness of the PPE to protect against hazards.

10.97. There appears to be no evidence to suggest that a regular monitoring or maintenance schedule for the PPE or equipment was instigated. For example, as previously reported one witness indicated that he had determined that there had been no record of the servicing of the Sabre respirators and all were out of date[137].

10.98. Incorrect storage procedures or storage in a contaminated environment of the PPE could have led to possible chemical exposure due to the residual chemical remaining on the PPE until it was re-used. According to a witness statement PPE was stored in the same area in which the actual spraying was being conducted[138].

Training

10.99. The training culture of the RAAF is competency-based: training and assessment are based on workplace-defined competencies[139]. The Confined Space Entry Course conducted, for all members participating in the Spray Seal process, is suitable for the requirements of training under DOHSMAN Chapter 7, Working in Confined Spaces. The formal requirement to conduct refresher training for confined space entry is in the DOHSMAN, which states:

10.100. "Apart from the initial training, the employees will receive biennial continuation training, and be subject to competency evaluations. Note: The approved competency based training course for a competent person has a currency of two years. Employees successfully completing the course are to have these training details kept for the period of employment."[140]

10.101. There appears to have been no formal process-training package conducted either 'off-the-job' or 'on-the-job' for spray sealing personnel.

10.102. Many of the chemicals used in the spray sealing process contain hazardous substances. The requirements for hazardous substance training are laid down in DOHSMAN:

10.103. 'Commanders/Managers are to ensure that adequate training is undertaken by employees, and their supervisors, who are responsible for the use of hazardous substances…The amount of detail and extent of training required will depend on the nature of the hazard and the complexity of work procedures and control measures required to minimise the risk of exposure.[141]'

Ventilation

10.104. AAP 7214.003-292-5 specifically prescribes the required ventilation, which includes two exhaust hoses and two supply hoses. The Armstrong Report highlighted that the Spray Sealant process could not be performed safely without the use of local supply and exhaust ventilation. Witness statements indicate that ventilation on occasions was not used at all or with a single extraction hose[142].

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136 IOI.0001.124, Investigating Officer interview of CPL Saunders at question 104; and IOI.0001.331, Investigating Officer interview of CPL McClymont at question 33.
137 EXP.0001.001, WGCDR Ross Report, relying on statement of CPL Saunders at page 26.
138 IOI.0001.262, Investigating Officer interview of SGT Mills at question 42.
139 DI(AF) AAP 2002.001, RAAF Training, Chapter 1, par 4b.
140 DOHSMAN, Chapter 7, Annex D, Working in Confined Spaces, Appendix 8.
141 DOHSMAN Chapter 5, Hazardous Substance Management, Annex A at pars 37 and 38.
142 EXP.0001.001, WGCDR Ross Report at page 46.

10.105. The requirements for ventilation during the Spray Sealing Procedure are contained in detail in AAP 7214.003-292-5, Spray Sealing of F111 Fuselage Fuel Tanks[143]. In the hierarchy of responses to hazards an engineering control such as ventilation should be used in preference to Personal Protective Equipment[144]. The requirements for ventilation during the process have been stressed since the RAAF were notified of Spray Sealing procedures, through the Trial to the conduct of the Program.

10.106. DOHSMAN provides that:

a. 'Atmospheric testing, for purposes including the determination of exposure levels, may be required [and] atmospheric testing and monitoring is carried out consistent with the hazards identified and the risk assessment.[145]'

10.107. Witness statements indicate monitoring was inconsistent and was primarily limited to the monitoring of LEL levels. Statements include:

a. 'No external monitoring of LEL's. Measured in tank in the morning then MEK wash no further LEL's taken, same for spray sealing. Eagles weren't allowed to be used in the tank with spray sealing as they would clog up[146]';
b. 'Can't take readings during spray sealing process…it destroys machines instantly[147]';
c. 'We were also aware that the LEL meter was not accurate. We knew this because the readings were all over the place. This meter was called a Minder…We were able to obtain a new meter known as an Eagle. The measurements from this meter showed that the LEL did not go below 7 or 8 when using MEK inside the tank. By the rules, no one should be there at those levels.[148]'

10.108. 'During the Spray Seal LELs were taken once at the beginning of the shift. The LELs was not constantly monitored because the MSA Minder would be covered in spray sealant. This was a problem because measurement of sealant levels would vary during the Spray Seal process [149]'.

143 PUB.0005.001, AAP 7214.003-292-5; 21 Jul 97.
144 DOHSMAN, Chapter 5 Hazardous Substances; Sep 98 at par 31.
145 DOHSMAN, Chapters 5, Hazardous Substance Management, Annex A at par 21.
146 IOI.0019.174 (at 188), Investigating Officer interview of CPL Anderson at question 34.
147 IOI.0019.144 (at 158), Investigating Officer interview of SGT Orwin at question 41.
148 WIT.0052.001 (at 015), Witness statement of Glen Steward Carmody at par 68.
149 WIT.0380.001 (at 007), Witness statement of Bradley John Frohloff at par 28.

ANNEXES

Annex A – Hierarchy of OH & S Regulations and Instructions

Annex B – Commonwealth Compensation Legislation

HIERARCHY OF OH & S REGULATIONS AND INSTRUCTIONS

OH&S Regulation

Legislation

10A.1. National *Occupational Health and Safety Commission Act* 1985.

10A.2. *Commonwealth Employees Rehabilitation and Compensation Act* 1988.

10A.3. *Occupational Health and Safety (Commonwealth Employment) Act* 1991.

a. 16(1) Employer must take all reasonably practicable steps to protect the health and safety at work of employees.

b. 16(2)d Develop policy for effective communication and mechanism for review.

c. 16(2)e Provide information, instruction, training and supervision

d. 16(5) Monitor employees' health and conditions, and maintain records.

e. 18(2)c Manufacturer to make available information re any condition necessary, when put to use as intended will be safe.

f. 21(1) Employee to ensure no act or omission that will create or increase risk, and cooperate re employer obligation.

g. 22(1)b Reasonable to rely on information from the manufacturer or supplier.

h. Regulations may make further mandates.

i. ADF members excluded by declaration of CDF (however, some of the intent could still apply – see DI(G) PERS 19-2.

10A.4. Occupational Health and Safety (Commonwealth Employment) Regulations 1991.

a. Under paragraph 3, the respray incident constitutes a dangerous occurrence.

10A.5. Occupational Health and Safety (Commonwealth Employment)(National Standards).

a. There are currently no provisions against Parts 6 and 7, Hazardous Substances and Confined Spaces respectively.

Workplace Health and Safety Act 1989 (Qld).

10A.6. Dangerous Goods Act (Commonwealth, and any QLD State precedent).

10A.7. Worksafe Australia National Codes of Practice (where relevant).

Defence Instructions

10A.9. ADO OH&S Policy Statement/CAF OH&S Policy Statement. Published on DSMA website but perhaps should be promulgated either in DIs and/or as the foreword to the DOHSMAN.

10A.10. DI(AF) ADMIN 1-1, Exercise of Command

10A.11. DI(AF) ADMIN 1-2 Command, Leadership and Discipline

10A.12. DI(G) PERS 16-1, DI(AF) PERS 54-1, Health Care of ADF Personnel

a. Requires prevention and/or reduction of the likelihood of disease or infirmity, as well as cure and restoration of health.

10A.13. DI(AF) PERS 53-4, Occupational Health Assessments

a. SMO assessment is required for activities identified by DI(AF) PERS 56-15 as exposing personnel to hazards which have the potential to adversely affect health.

10A.14. DI(G) PERS 19-2, DI(AF) PERS 60-1, OH&S(CE) Act 1991, Implementation Within the ADF

a. Paraphrases the Act.

b. Advises of CDF's exemption declaration (first but not second) and amplifies the effect of this, as well as giving additional guidance on other aspects of implementation.

c. Annex D permits a risk management approach to operations and training to exercise discretion when strict application of the Act would be prejudicial to Australia's defence.

d. A bit lengthy and not sufficiently clear on Committee structure. Para 69 says 'all ADF members of Safety Committees are commander's representatives'. HSRs are the only employee representatives.

e. Committees to meet at least three monthly.

f. Some confusion is created by having instructions for the Department, the ADF and Air Force, but none for the ADO (until DOHSMAN level).

10A.15. DI(AF) PERS 60-10 Air Force OH&S Management Structure and Functions

a. Wings must have OH&S committees, chaired by OC. Their task is to keep under review the identification of hazards, investigation of accidents/incidents, and OH&S training.

b. Must meet at least quarterly.

c. All Air Force members are to be members of a SIT

d. Specifies training requirements for OHSA, SITL and HSR

10A.16. DI(G) PERS 19-20, DI(AF) PERS 60-20, OH&S - Contractor Safety Management

10A.17. DI(AF) PERS 60-3 Identification, Reporting and Control of Hazards Policy and Procedures and DI(AF) PERS 56-15 OH&S – Identification, Evaluation and Control of Workplace Hazards

a. There are no provisions in DIs(G) or DOHSMAN.

b. Commanders are to discontinue activities if moderating controls are unable to reduce the risk to 'acceptable levels'.

c. 'Acceptable risk' is not defined. There is a risk score calculator tool on the DSMA website but it probably needs refinement. DOHSMAN refers to AS/NZS 4360 – Risk Management.

10A.18. DI(G) PERS 19-5, DI(AF) ADMIN 11-12, Notification of Casualties and Dangerous Occurrences in the Defence Organisation

a. Notice to Comcare iaw OH&S(CE) Act 1991

10A.19. DI(AF) PERS 60-4 Reporting and Recording of Injuries, Occupational Illnesses and Deaths Arising From Ground Incidents – Policy and Procedures

10A.20. DI(AF) PERS 60-7 Occupational Health and Ground Safety Audits

10A.21. DI(G) PERS 19-18, DI(AF) PERS 60-19, Defence Occupational Health and safety Manual

10A.22. DI(G) PERS 19-8, DI(AF) PERS 60-11, Personal Protective Equipment

10A.23. DI(G) PERS 19-9, DI(AF) PERS 60-14, Working in Confined Spaces

10A.24. DI(AF) OPS 6-1 Flying Safety Philosophy and Policy

10A.25. DI(G) LOG 07-8, DI(AF) LOG 16-1, Management of Hazardous Substances Except Dangerous Goods in Class 1 (Explosives) and Class 7 (Radioactive Materials)

10A.26. DI(AF) SUP 17-4 (Superseded) Toxic/Hazardous and Potentially Hazardous Substances – Administrative Procedure to Facilitate Control

Superseded DIs(AF) TECH

10A.27. DI(AF) TECH 29-1 Safety Precautions in the Use of Chemicals and Processes which Jeopardize the Health of Personnel

10A.28. DI(AF) TECH 29-2 Safety and Health Hazards – Personnel Protective Equipment

Defence Manuals

10A.29. Defence Occupational Health and Safety Manual (DOHSMAN), to be supersede by SAFTEYMAN.

10A.30. AAP 6700.001, .002, .003, RAAF Ground Safety Manual (succeeded by DOHSMAN).

a. AAP818 (predecessor to AAP 6700.001).

10A.31. Occupational Health and Safety Manual (OHSMAN1).

a. Policy and procedures for Defence civilian employees; partially succeeded by DOHSMAN).

10A.32. AAP 3504.001 Hazardous Goods Management Manual

10A.33. AAP 6734.001 Manual of Flying Safety

National Standards

a. AS 1216 - Classification, Hazard Identification and Information Systems for Dangerous Goods.

b. AS 1336 - Recommended Practices for Eye Protection in the Industrial Environment.

c. AS/NZS 1715 - Selection, Use and Maintenance of Respiratory Protective Devices.

d. AS/NZS 1716 -, Respiratory Protective Devices.

e. AS1885 & 1885.1 - Measuring OH&S Performance.

f. AS 2161 - Industrial Safety Gloves and Mittens.

g. AS/NZS 2865:1995 - Safe Working in a Confined Space.

h. AS 2919 - Industrial Clothing.

i. AS/NZS 3931:1998 - Risk Analysis of Technological Systems.

j. AS/NZS 4360:1999 - Risk Management.

k. AS 4801:2000 - OH&S Management Systems - specification with guidance for use.

l. AS/NZS 4804:1997 - OH&S Management Systems - general guidelines on principles, systems and supporting techniques.

m. AS/NZS 14001:1996 - Environmental Management Systems.

n. NOHSC: 1003 (1995) National Exposure Standards.

o. NOHSC: 1005 (1994) Control of Workplace Hazardous Substances, National Model Regulations.

p. NOHSC: 1008 (1994) Classifying Hazardous Substances.

q. NOHSC: 1014 (1996) National Standard for Control of Major Hazardous Facilities.

r. NOHSC: 2007 (1994) Control of Workplace Hazardous Substances, National Codes of Practice.

s. NOHSC: 2016 National Code of Practice for Control of Major Hazardous Facilities.

t. NOHSC: 3008 (1995) Exposure Standards for Atmospheric Contaminants in the Occupational Environment - Guidance Notes.

u. NOHSC: 3017 (1994) Assessment of Health Risks.

v. NOHSC: 10005 (1994) Designated Hazardous Substances.

w. National Standard for Control of Major Hazardous Facilities?

x. Standards Australia Handbook: Occupational Personal Protection (SAA HB9-1994).

y. Worksafe Australia: National Model Regulations for the Use of Workplace hazardous Substances.

Courseware and Course Terminal Objectives (CTO)

a. Managing OH&S (1 day).

b. Workplace Safety Management (3 days).

c. Advanced OH&S Management (10 days)(?)

d. RAAF OHS Adviser Course.

e. RAAF CO’s Course (1 hour lecture); RAAF Commanders and Managers Guide.

COMMONWEALTH COMPENSATION LEGISLATION

Comcare Scheme

B.1. The *Safety Rehabilitation and Compensation Act* 1988 (Cth) ("the SRC Act") came into operation on 1 December 1988[1]. The SRC Act covers all Commonwealth employees for injuries arising out of or in the course of employment. Comcare and the Safety, Rehabilitation and Compensation Commission are established under the SRC Act, which outlines the role and functions of both bodies including administrative, regulatory and service responsibilities.

B.2. The SRC Act includes a comprehensive benefit structure:

a. payment of lump sums for permanent impairments;
b. a fully-funded approach where employers are financially accountable for the cost of work-related injury and disease through the payment of annual premiums to Comcare;
c. a 'no fault' scheme, with limited access to common law;
d. a comprehensive benefit structure with an entitlement to compensation payments for 45 weeks at 100 per cent of normal weekly earnings, and 75 per cent thereafter;
e. employer responsibility for the occupational rehabilitation of injured employees;
f. coverage of allowable medical, rehabilitation and related costs associated with the treatment of work related injury and diseases;
g. entitlement to incapacity payments until age 65;
h. provisions which limit Comcare entitlements where a person is in receipt of a benefit under a superannuation scheme whether by way of a lump sum or a pension; and
i. coverage for journeys and ordinary recesses (for example meal breaks).

B.3. The SRC Act is mirrored in the *Military Compensation Act* 1994 (Cth) ("the MCA"). The MCA is administered by the Department of Veterans Affairs and any members of the military who believe that they suffer from a work-related injury can test their entitlements by lodging a claim with DVA. This advice refers only to the SRA Act and the Comcare scheme.

B.4. The Military Compensation and Rehabilitation Service (MCRS), part of the Department of Defence, administers under delegation from Comcare[2] claims not only under the SRC Act but also under earlier legislation, that is, the *Compensation (Commonwealth Employees) Act* 1971 (Cth) and the *Commonwealth Employees Compensation Act* 1930 (Cth).

Injuries prior to 1st December 1988

B.5. All Commonwealth workers compensation legislation prior to the commencement of the Comcare scheme has been repealed. The former legislation was *the Commonwealth Employees Compensation Act* 1930 (Cth) ("the 1930 Act"). That Act was replaced by the *Compensation (Commonwealth Employees) Act* 1971 (Cth) ("the 1971 Act") on 25 May 1971.

B.6. The SRC Act contains transitional arrangements for injuries arising that would have otherwise been determined under the 1971 Act or the 1930 Act. A claim for a disease contracted while the 1930 Act was in force, but made after 1988 is a claim made under the 1988 Act by force of s 124 of the SRC Act. These transitional arrangements under the SRC Act are highly complex and have been interpreted by the Federal Court on a number of occasions. All payments for workers compensation are now made under the SRC Act and

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[1] This Act is now administered within the Department of Veterans' Affairs (DVA) by the Military Compensation and Rehabilitation Service (MCRS). The Director of the Military Compensation and Rehabilitation Service (DMCRS) in DVA is responsible for the formulation of operational policy, provision of advice, training and a consultation service nationally for the MCRS function. Claims processing is administered by MCRS offices within DVA in every Australian capital city (and Townsville).

[2] Comcare is the workers' compensation insurer for the Commonwealth, providing safety, rehabilitation and compensation services to Commonwealth employees under the auspices of the Safety, Rehabilitation and Compensation Commission.

that Act governs entitlements which are payable and the level of compensation for injuries arising prior to 1st December 1988.

The First Deseal Reseal Program (Oct 1977 - Feb 1982)

B.7. At the beginning of the First Deseal/Reseal Program the *Compensation (Commonwealth Employees) Act* 1971 (Cth) was the relevant legislation.

The Wing Tank Deseal Reseal (Aug 1985 - Jun 1992)

B.8. There was a significant legislative change during the period of the Wing Tank Deseal/Reseal program (1 December 1988). The *Compensation (Commonwealth Employees) Act* 1971 (Cth) was repealed by the *Commonwealth Employees Rehabilitation and Compensation Act* 1988 (Cth). (That Act gave more credence to rehabilitative measures rather than purely dealing with compensation payments.) The Act establishes a fully-funded premium-based system and a licensed self-insurance based system of compensation (and rehabilitation) for employees who are injured in the course of their employment. It covers all Commonwealth employees, including members of the Australian Defence Force (ADF).

The Second Deseal Reseal Program (Apr 91 - Aug 93)

B.9. Subsequent to the SRC Act, the Military Compensation and Rehabilitation Service (MRCS) was established within the Department of Defence.

The Spray Seal Program (Mar 1996 - Nov 1999)

B.10. Prior to the commencement of the Spray Seal Program, the Military Compensation Scheme was established. This Scheme was introduced on 7 April 1994 by the *Military Compensation Act* 1994 (Cth) ("MCA"). The main objective of this was to remove coverage under the *Veterans' Entitlements Act* ("VEA") for peacetime service for the majority of ADF members. The exception to this was for members who had enlisted before 22 May 1986 and had continually served up to and after 7 April 1994. Duel eligibility under the VEA and SCR Act would still be provided for members on operational service.

B.11. The MCA also extended cover under the provisions of the SRC Act to include holders of honorary rank, members of philanthropic organisations providing services to the ADF and to those involved in approved post-discharge resettlement training.

B.12. Further changes were introduced after the March 1997 Inquiry into Military Compensation arrangements for the ADF. The most obvious change that resulted was the adjustment to payments for severe Injury under the SCR Act. The maximum payment was increased to a CPI figure of $200,000 plus $50,000 for each dependant child. The death benefit figure was also increased to a CPI linked amount of $200,000 plus $50,000 for each dependant child[3].

B.13. These arrangements remained during (and continued on after the end of) the Spray Seal Program.

B.14. On 3 December 1999 the administration of the Military Compensation and Rehabilitation Service (MCRS) was transferred from the Department of Defence to the Department of Veterans' Affairs ("DVA"). Personnel wishing to make a claim for compensation during this period would complete a claim form (now AB168) to be submitted to the MCRS. The responsibility for administering military compensation is given to the DVA under delegation from Comcare[4].

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3 As at December 1998 the amounts are $203,000 and $50,750.

4 Irrespective of whether a claim form is submitted, incidents that might entitle an employee to gain benefits under the legislation are supposed to be reported to a superior. The superior is then required to complete an Incident Form (AC563). A copy is placed in the member's file. Since August 1999, the incident forms

Common law claims

B.15. ADF members may be entitled to damages or compensation at common law, under other State and Territory legislation (for example, Motor Vehicle legislation) or under s 45 of the 1988 SRC Act if they are able to demonstrate that their injury or disease was caused by the negligence of another person (including the Commonwealth) or occurred in circumstances
B.16. that may attract a statutory entitlement.

Claims against the Commonwealth

B.17. The SRC Act also abolished the common law right to sue the Commonwealth for economic loss (loss of salary), however, the High Court has limited this restriction to injuries occurring on or after 1st December 1988 when the SRC Act commenced. It is possible to forego future Comcare entitlements if a common law claim is successful. The SRC Act also contains pay-back provisions where Comcare payments have been made and common law damages have been received. The SRC Act also places limits on the amount of compensation payable under common law. If a person takes common law action and is then dissatisfied with the outcome of that action, they cannot subsequently apply for additional compensation under the SRCA in certain instances.

Actions against third parties

B.18. If a person is injured or dies in compensable circumstances and a third party (someone other than the Commonwealth) appears liable to pay damages, then that person or their dependants may take common law action against the third party. Such action is not restricted by any provisions of the SRCA[5].

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have been submitted to the newly established Defence Safety Management Authority (DSMA). DSMA enters the incident into the DEFCARE database. If the injury is of a serious nature (ie. a dangerous occurrence, incapacity, serious personal injury or fatality) then the form must also be lodged with COMCARE.

5 If a person or their dependants does take common law action against a third party, and if damages are consequently paid, the MCRS must be notified. Any such damages are offset against compensation paid or payable to the person or their dependants under the SRCA.

CHAPTER 11 - COMPLIANCE WITH INSTRUCTIONS

Summary

11.1. At the commencement of the public hearings on 28 February 2001, the Board President stated:

> 'The incidence of reported workplace transgressions are numerous and it appears occurred consistently over a period of some 27 years. The Board's investigation has led to a preliminary view that much of that which requires close scrutiny concerns systemic issues. At this point it is considered that given the many transgressions which have occurred over a period of 27 years there would be little utility in closely examining all of them particularly as many persons have now left the service. Such detailed examination would not assist the Tribunal as it understands the issues at this point in considering remedial action, finding out what happened and meeting the other requirements of the terms of reference.'

11.2. The Counsel Assisting the Board also noted during their closing submission that:

> 'Although there is some contest in the evidence between ground crew and their supervisors, there seems little doubt that there was fairly widespread non-compliance with procedures and policies required to be complied with, notably in the wearing of suitable personal protective equipment. The evidence is that, in all but a very few cases, no formal action was taken under the *Defence Force Discipline Act* or its predecessors against those involved
> …
> 'The Board made it very clear at the outset that it did not wish to identify individual failings but rather systemic failings, and in those circumstances, and also given the previously mentioned rulings of the Board on the unsuccessful applications for possibly affected persons to be joined, it is not now appropriate to make individual findings of fault against any person.'

11.3. The point of these statements is that there were many instances, and claims, of duties not being performed in accordance with promulgated procedures and policies. Too many in fact to warrant investigation, and such effort would not have promoted the Board's work. The comments in this chapter are therefore of a general nature and concern only the first, wings and spray seal programs save for where they are expressly directed to the second program. The other consideration in judging 'the extent to which personnel performed their duties in accordance with procedures and policies … ' is the quality of the instructions and the degree of discretion allowed. For example, guidance on supervision is broad in context hence there have been many and varied views on the extent that supervisors correctly performed their duties. One area that became better defined over time was the OH&S considerations.

11.4. There were very rare instances where non-compliance was probably due to defiance. More likely, non-compliances were due to a lack of appreciation of the possible consequences of the omission, when either endeavouring to get the work done, or the PPE, or support equipment created discomfort.

Workforce Culture

11.5. On the first program, there is evidence of the culture of the workforce playing an important part in non-compliance in the use of PPE. Representative examples are given in the following statements:

a. ‘The work culture that existed at the time was that PPE was not really needed, and the NCO’S did not enforce it’s use.‘[1]; and

b. ‘The general work culture concerning the use of PPE was pretty lax.’ [2].

11.6. There was some carryover of this macho attitude in the wings program but by the late 1980s the change of OH&S legislation was beginning to have the desired effect on the shop floor and there was less reluctance to wearing protective equipment. This attitude was also affected by the quality of the hazardous substance instruction given to the workforce. Many people from the early programs expressed the opinion that they felt the protective equipment was specified to protect the aircraft tanks and to make clean-up easier, more so than to protect their health.

Supervision

11.7. A brief comment was made above on the subjective nature of judgments on supervision given the nature of supervision guidance. This is one topic that is somewhat contentious because of the differences in perspective between those with the responsibility of supervising and those being supervised. Of course, working in confined spaces limits the amount of direct supervision that is practical. As well, a working environment that requires protective equipment to be worn limits the amount of indirect supervision because the inconvenience of the routine deters managers from attending when work is being conducted.

11.8. There were instances given in evidence where it is likely that the level of supervision provided was inadequate for the task and the working environment. More usually though, the adequacy of supervision is in contest where the supervisor was not properly aware of the hazardous nature of the tasks being supervised:

a. ‘Quite often you would be in a tank the whole day without anyone checking on you and there was sometimes little supervision in that regard.‘ [3];

b. ‘The general workforce culture concerning the use of PPE was that the items should be used where they could be used, but use was not policed stringently. PPE was considered uncomfortable, cumbersome and got in the way of doing the job at times. Getting the job done was the priority, and we just did what we were told. I only saw people chastised about non-use of PPE after an accident had recently occurred.’[4]; and

c. ‘Initially our supervisors believed that due to the fact that we had air pumped through the tanks that it would not be necessary for us to be wearing our respirators.’ [5].

The Board comments on the above at Volume 1 chapter 3 - Limitations of the Chain of Command, and Volume 1 Chapter 4 – Impact of Production Pressures, on the matter of supervisors and supervision.

Use of Personnel Protective Equipment (PPE)

11.9. The general use of PPE on the first program appears to have been dictated by factors other than the toxicity of the chemicals in the work environment. The PPE tended not to be worn when the perceived risk was minimal, there was little smell, or if it was uncomfortable or impractical. There were also problems with wearing some forms of PPE in the confined spaces of the tanks. Witness statements included:

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1 WIT.0171.001, at par 25.
2 WIT.0323.001, at par 27.
3 WIT.0114.001, at par 22.
4 WIT.0360.001, at par 28.
5 WIT.0456.001, at par 23.

a. 'For example, if it was hot then respirators and goggles and overalls became uncomfortable and quite often these were [simply] removed by people working in the fuel tanks.'[6];

b. 'All of this equipment was used by most of us most of the time but certain items were not used when it was uncomfortable or impractical to do so. For example, respirators were removed when working in a confined corner of a fuel tank because they simply hampered vision.' [7]; and

c. 'I raised the fact that we could not wear respirators in some areas with the Flight Sergeant and Flying Officer. I cannot recall their exact response, however, I think it was the same as mine, and that was we were to wear the respirators when we could. The failure to wear the respirator was only because of the physical limitation.' [8].

11.10. For the second program, witness statements regarding the wearing of PPE are inconsistent with their observations regarding supervision. A number of witnesses indicate that their managers took an active role in enforcing the wearing of PPE stating, for example, that the wearing of PPE was strictly enforced and was part of instruction and training[9]. Other witness statements, however, state that PPE was occasionally not worn[10], that PPE enforcement was inconsistent and that the wearing of PPE was to a degree discretionary [11]. Management witnesses questioned the veracity of certain of these statements[12]. The Board accepts that there were some non-compliances but notes the substantial attention given to OH&S matters generally by the company.

11.11. Use of PPE when working on the aircraft on the spray seal program was generally compliant with instructions, however, this was not always the case when working outside the aircraft:

a. 'The spray guns were tested by flushing them with MEK and I have observed people doing this without any PPE. In particular without a respirator. I would be standing close by with a respirator and would notice the fumes mist up from the MEK.' [13]; and

b. 'Wouldn't use your respirator in an open area, hangar to a certain extent was ventilated. Also guys would mix the sealant with no respirator on.' [14].

There were also a number of occasions when PPE was used beyond its useful life; for example sometimes respirator cartridges were overused and overalls were torn, because replacements were not readily available and there was some pressure to minimise consumption.

11.12. Not always wearing PPE was evident on stages of the wings program as well:

a. 'I do not recall there being a lack of supervision, but I do recall having to nag some people about wearing PPE. Some of the younger staff were a bit blasé about the work.' [15];

b. 'However, when it came to using PR1750, I would not necessarily wear the mask all the time if I was in a well-ventilated area. Its smell is much less strong than Mil-Spec or Q4. For example, on a Wing Plank re-laying, when there was lots of PR1750 around, virtually no one would wear their respirator. The hangar doors would generally be open during the procedure

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6 WIT.0202.001, at par 32.
7 WIT.0058.001, at par 21.
8 MAN.0042.001, at par 43.
9 See for example, WIT.0025.001, at par 60, WIT.0013.001, at par 25.
10 WIT.0288.001, at par 26.
11 See for example: WIT.0011.001, at par 28; WIT.0012.001, at par 12; WIT.0070.001, at par 34; WIT.0063.001, at par 23; WIT.0205.001, at par 19; WIT.0227.001, at par 24.
12 WIT.0515.001 ,Statement of Barry Thomas McGrath at pars 32-47.
13 WIT.0469.001 (at 007), at par 34.
14 IOI.0019.174 (at 180), at question 20.
15 WIT.0325.001, at par 9.

and I think that most people felt there was no particular need to wear a respirator then.' [16]; and

c. 'We were also supposed to wear the gloves when using the sealants. However, this was often quite impractical, especially with the PR1750 sealant. If that got on the gloves, you really could not continue using them without spreading the sealant elsewhere. Also, if you had to work with screws at the time, you could not get adequate feeling through the gloves to do the task.' [17].

11.13. While there were many occasions when supervisors chipped workers for not wearing PPE if instructions required it to be worn, there were also many times when the non-compliance was not directly evident to the supervisors.

Training

11.14. Hazardous Substance Training. At the very least, the requirements for hazardous substance training were not complied with from the issue of DOHSMAN in 1998[18]. The consequences potentially included:

a. using the chemicals incorrectly;

b. handling the chemicals incorrectly;

c. being complacent due to lack of knowledge of chemicals;

d. using the wrong protection;

e. using incorrect disposal procedures; and

f. inability to react to an emergency.

A clear example of the first consequence is that plastic spray bottles were used on all programs to dispense MEK/'MILSPEC' in lieu of the instruction to wipe on with a rag. This action increases the atomisation of the solvent and thus increases the inhalation and explosive risks.

Disposal of SR51

11.15. The thiophenol constituent of SR51 was supposed to be neutralised before being burnt. The Board could not find evidence of sodium hypochlorite pre-treatment or of autoxidation by allowing the chemical to stand for a minimum of four weeks. The used SR51 also did not usually have the sealant residue separated and this was the cause of furnace-filter blockages and burning disruptions. The blockages produced back-pressure in feed lines and line failure at many unions, spraying and spilling SR51.

Incident and Hazard Reporting

11.16. The requirement for incident and hazard reports has been longstanding and stated in a variety of evolving instructions. These instructions can be identified at annex A to chapter 10 in this volume. There were many incidents related in evidence when a report was appropriate however few people involved considered submitting such a report. The reasons given usually related to only considering submitting a report if serious injury or equipment damage was present. More complete discussion is presented at chapter 5 of Volume 1.

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16 WIT.0018.001, at pars 22 and 23.
17 WIT.0115.001, at par 24.
18 DOHSMAN Chapter 5, Hazardous Substance Management, Annex A at pars 37 and 38.

Non-Compliance with Technical Process – Spray Seal

11.17. There are a number of steps in the spray seal process that were not followed. In most cases this was caused by the pressure to complete the work within a given time. The non-compliances were:

a. High pressure hot water cleaning of tanks was not always done, probably because of the mess it created and that there was a further step in the cleaning process. This non-compliance meant reliance on the solvent clean and hence greater use of the solvents than would otherwise have been necessary;

b. Atmospheres were not always monitored. During the spray application the monitors would readily clog. When they were used they could show higher than permitted readings which were ignored, eg 'the measurements … showed that the LEL did not go below 7 or 8 when using MEK inside the tank. By the rules, no one should be there at those levels[19]'; and

c. Ventilation. During the Spray Sealing process venturis were generally not used as air exhaust systems. The available venturis were not fitted with the correct fittings for attaching to the aircraft. This made them noisy and inefficient. As a result, the venturis were used on a small number of aircraft only. (Note: the HDU-13 had the capability to both supply and exhaust, however, was not used for spray seal ventilation.) Also, forced air ventilation during spray application fell from use because it tended to stir the atmosphere, making the spray more difficult, and because the hose took a fair amount of space in the already congested tank access port.

Workplace Audits

11.18. Workplace hazard audits were required to be conducted annually, however in the years preceding the suspension of FTRS spray seal work at Amberley they were not conducted. The main reason given for the failure to audit was the pressure and workload created by the 501WG market testing activity. The subject of audits is discussed in full at Volume 1 chapter 8.

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[19] WIT.0052.001 (at 015), at par 68.

CHAPTER 12 - PERSONNEL WHO MAY HAVE BEEN EXPOSED

12.1. Lists of all identified personnel, as comprehensive as the state of the evidence permits, is provided at annex A. There are also a number of tables below which seek to summarise in relation to each process and then each sub-aspect of the process, the details of the process and the individual duties of personnel in that process.

12.2. Both RAAF members and contractor staff were employed at various stages across the four programs. Some of these were females. Hawker De Havilland conducted the second program under contract and AWASCo provided contract labour staff to supplement the Air Force workforce during the wing program. The main RAAF (and civilian equivalent) trade used was Airframe Fitter (AFITT) for the first, second and wings programs, then Aircraft Technicians (ATECHs) following trade restructuring in 1992. They were supplemented by other trades from time to time, predominantly Engine Fitters and Motor Transport Fitters, and especially during the first program. Most of those whose employment clearly fits within the maintenance programs described in the Terms of Reference were identified and contacted/interviewed. Some who could be said to have been partially involved were included in the witness program, but many others with similar employment history to this latter group were not. Quite simply, there needed to be a limit set to the categories of witnesses, beyond which the work of the Inquiry was most unlikely to be enhanced.

12.3. The exact number of tradespeople and supervisors employed on the various stages of the deseal/reseal programs and on closely allied duties proved very difficult to determine because the workforce was quite fluid. During the course of the Inquiry, approximately 700 people were identified as having been involved at the working level to some degree. Their names were determined from FTRS records, RAAF posting and attachment records, and contractor staff records in the first instance, and then as named by other witnesses. There is a high level of confidence that those identified represent the full complement of people involved across the four programs. From this group, 497 we identified as likely to have been exposed to DR chemicals in some form. These tradespersons and supervisors are those listed in Annex A.

DUTIES OF PERSONNEL EMPLOYED ON THE DESEAL/RESEAL AND SPRAY SEAL PROGRAMS

12.4. With very rare exceptions, the witnesses were amenable to being interviewed and to giving statements. A good number of them believe they have permanent medical conditions as a consequence of their employment on deseal/reseal duties. Many of them report ailments which could be classed as tolerable, while many of these with more serious ailments have to date not been prepared to ‘fight the bureaucracy’ to prove their claim. This group therefore welcomed the opportunity to put their story on record. Their claims notwithstanding, most witnesses generally feel they enjoy good health.

12.5. For the Air Force people, many of those posted to DR duties were young and came straight from their trade training, hence had a minimal amount of trade experience. They were airmen who were assigned without preference for the work and who were very reluctant to question their instructions. By contrast, those employed on the second program had applied for their jobs and many came with relevant experience from working as AFFITTs.

12.6. The following tables provide a comprehensive listing of the trade duties across the deseal/reseal and spray seal programs:

1st Deseal/Reseal Process

Process	Process Detail	Duties
Chemical Deseal	Fit deseal plumbing, sprinklers, spray nozzles Score/slash sealant	Fitting (& defitting) Rig Monitor Trade and Independent Inspections
	Fill deseal rig with SR51, preheat	
	SR51, SR51A circulation. Spot repair plumbing leaks. Spot Checks	
	Drain SR51 into storage tank or drums	
	Fill rig with Alkali wash (ED500 and water)	
	Circulate then drain into dam	
	Fill with fresh water, rinse & drain	
	Clean out Deseal rig (remove sealant sludge)	
	Remove deseal plumbing and residue (water, loose sealant)	
	Hand scrub with ED500 solution	
Water Pick	Fit blanking plates, protective tape	Waterpick/Hydrolaser operator Safety observer Runner
	Waterpick sealant	
	Wash with ED500 solution Rinse with high-pressure hose (fire hose)	
Hand Clean with Mil-Spec	Clean with Mil-Spec, cheesecloth soft metal scrapers, bristle brushes and dental tools	Hand cleaner Trade and Independent inspectors
Primer Application	Flush with PR148 and remove excess	General tech and inspectors
Barrier Application	Mix 2-part Epoxy (in sealant hut)	Sealant Quality control General technicians Inspectors
	Apply epoxy barrier XA 3598 with semco gun	
Sealant Application (2 coats)	Mix sealant (A & B)	Sealant Quality control General technicians Inspectors
	Apply A Sealant	
	Apply B sealant	
Dispose of SR51	Transfer waste to incinerator	General hands Boiler attendants
	Transfer waste to dam and collect with tech blocks Incinerate tech blocks	
	Monitor incinerator Clear blockages/breakdowns	

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2nd Deseal/Reseal Process

Process	Process Detail	Duties
Water Pick	Fit blanking plates, protective tape Waterpick sealant Wash with ED500 solution Rinse with high-pressure hose (fire hose)	Waterpick/Hydrolaser operator Safety observer Runner
Hand Clean with Mil-Spec	Clean with Mil-Spec, cheesecloth soft metal scrapers, bristle brushes and dental tools	Hand cleaner Trade and Independent inspectors
Barrier Application	Mix 2-part Epoxy (in sealant hut) Apply epoxy barrier XA 3598 with semco gun	Sealant Quality control General technicians Inspectors
Sealant Application (2 coats)	Mix sealant (A & B)	Sealant Quality control General technicians Inspectors

Wing Deseal/Reseal Process

Process	Process Detail	Duties
Water Pick	Remove sealant with waterpick/hydrolaser	Operator Observer
Seed Blasting	Remove sealant with walnut shell blaster	
Hand Cleaning	Wash with ED500 Clean with Mil Spec Remove by hand all remaining sealant	General tech
Reseal wing	Flush with PR148 Mix 2-part epoxy Apply Epoxy Barrier Prime with EC1945 Brush coat Q4 sealant Apply sealant Q4 with Semco gun	General tech Trade & Independent Inspectors
Refit Plank	Wipe down top-skin panel with Mil Spec Wipe down top-skin panel with PR148 Mix PR1750 B sealant Apply PR1750 B sealant to top-skin panel Refasten panel while sealant is wet (6 hour time limit)	

Spray Seal Process

Process	Process Detail	Duties
Alkali wash	Rinse with detergent wash with high-pressure hose, rinse with hot water	General tech
Spot Clean	Wipe down tank surfaces with Mil Spec	General tech
Primer Application	Mix primer	Sprayer
	Apply primer with manoeuvrable pressure pot	Observer Mixer General tech
Sealant Application	Mix A sealant	Sprayer
	Mix B sealant	Observer
	Apply A sealant with air-assisted airless gun	Mixer
	Apply B sealant with air-assisted airless gun	General tech
	Inspect and patch up	Trade & Independent Inspectors

PERSONNEL EMPLOYED ON CLOSELY RELATED DUTIES

12.7. Aircraft undergoing R4 and R5 servicings between the formal DR programs often had the need for individual fuselage fuel tank repairs. So too some aircraft allotted from the operating squadrons. As well, through the early to mid 1980s there were maintenance programs for vent tanks and weapons bay tanks. None of this activity is formally part of the Inquiry, however, the very similar working environment warrants comment. Whilst these aircraft were repaired quicker, the amount of time tradespeople spent in tanks and the amount and types of chemicals they used were similar in many respects to the conditions experienced by those employed on the second program. The vent tanks and weapons bay tanks were similar to the wings program. The procedures for these repairs are described in AAP 7214.003-3 Section 2 and, in summary are:

a. drain and purge the tank needing repair;

b. identify and mark defective sealant and epoxy barrier areas;

c. remove defective sealant and barrier using ‘plastic, wood, or aluminium scrapers’, and cut back adjacent areas of good sealant;

d. clean all surfaces being repaired by wiping with MIL-C-38736 solvent, then dry;

e. repair tank corrosion protective coating as required using alodine, and MIL-C-27725 primer and polyurethane paint;

f. roughen all repair surfaces using scotchbrite pads dampened with MIL-C-38736 solvent;

g. wipe repair surfaces with PR148 adhesion promoter (note that this step was discontinued in 1991 during the second D/R program);

h. apply epoxy barrier EC2216 along faying surface seams;

i. scuff the surface of the epoxy using a cheesecloth dampened with PR148 adhesion promoter;

j. apply MIL-S-83430 class B polysulphide sealant to repair areas.

k. leak check.

12.8. A number of these people were identified and were invited and gave evidence, but this list is by no means complete. The people so affected are listed under 'other…DR maintenance' at annex A. Similar work was also conducted within 82 Wing squadrons but people so employed did not do the work continuously. Some of these airmen also gave evidence and their names are included in the aforementioned list, although they do not fall within the category of people addressed by TOR3b(1).

PERSONNEL WORKING IN SUCH PROXIMITY AS TO BE AT RISK

12.9. The most evident of the groups who worked in close proximity to the DR activity are the Base Squadron Amberley Boiler Attendants whose job it was to dispose of the SR51 by incineration. Their names have been included in the list for the first program as being personnel who 'may have been exposed'. In fact, there was little doubt they were exposed.

12.10. Surface Finishers (SURFINs) were used to repair the fuel tank paint as required. This work has been a long-standing task for this mustering. As was the work of Electrical Fitters/Avionics Technicians who were used to remove and then reinstall electrical components within the fuel tanks, and Non Destructive Inspection (NDI) technicians who were required to perform structural inspections before tanks were resealed. Some of the airmen identified from these musterings, as well as supply staff, have been included in the list of other…maintenance tradespeople' at annex A as personnel who were employed on related duties.

12.11. Some of the people employed on the programs were more predisposed to suffer from effects of exposure and working in confined spaces than others. People in this category were sometimes moved to other work areas when ill effects became evident. That said, to a great extent the attitude amongst the work group was simply to get on with the job and tough out any difficulties. The duties were unpleasant but the job had to be done, and pitching in was a means of helping mates. Commanders understood the very tedious and unpleasant nature of deseal/reseal work but tended to be strict and unsympathetic with those who complained, this being a means of supporting the great majority of tradespeople who showed commendable loyalty by simply getting on with the job.

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ANNEXES

Annex A – List of Personnel Who May Have Been Exposed to Hazardous Chemicals and Their Duties

Annex B – Photographs of Deseal/Reseal Section Personnel 1980-1992

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LIST OF POTENTIALLY EXPOSED PERSONNEL

1ST DESEAL/RESEAL PROGRAM

NAME	OCCUPATION	PERIOD
AGERBEEK – RUDOLF	SUPERVISOR	1977-1979
ALLEN – MICHAEL JOHN	SUPERVISOR & TRADESPERSON	1977-1978
ANSELL – CHRISTOPHER MARK	TRADESPERSON	1982
BALE – CHRISTOPHER JAMES	TRADESPERSON	1983-1986
BARRETT – DAVID MICHAEL	TRADESPERSON	1981-1982
BAZZO - VIVIAN JOHN	TRADESPERSON	1979-1980
BEEKEN – RICHARD -	TRADESPERSON	1980-1982
BENTLEY – STEPHEN JOHN	TRADESPERSON	1979
BETTERHAM – PAUL ALEXANDER	TRADESPERSON	1975-1979
BISHOP - GARY NORMAN	TRADESPERSON	1981-1982
BRIDGE - GARRY ALFRED	TRADESPERSON	1979-1980
BROAD – RICHARD HENRY	TRADESPERSON	1981-1983
BROWN – GEORGE WAYNE	TRADESPERSON	1981-1982
BURRIDGE – JONATHAN CURTIS	TRADESPERSON	1980-1982
CARVOSSO – JOHN PHILLIP	TRADESPERSON	1978
CLARK – RONALD JOHN	SUPERVISOR	1984-1985
COLLINS – DONALD JOSEPH	TRADESPERSON	1979-1980
COONAN – STEWART JOHN	TRADESPERSON	1978-1979
COOPER – FRANCIS BERNARD	TRADESPERSON	1978
COPELAND – ALAN RONALD	TRADESPERSON	1977-1978
COX – FREDERICK STANLEY	TRADESPERSON	1980-1982
CRIMEAN - JOHN MICHAEL	TRADESPERSON	1979
CROWLEY – CORNELIUS MICHAEL	TRADESPERSON	1981-1983
CURL – GEOFFREY MICHAEL	TRADESPERSON	1981-1982
DAVIS - BRUCE ROBERT	TRADESPERSON	1978-1980
DE JONG – PETER MARTIN	TRADESPERSON	1977-1978
DELATORRE – ANTHONY P	SUPERVISOR	1981
DOGGETT – DENNIS RAYMOND	SUPERVISOR	1980-1982
DOHERTY – DESMOND ROBERT	SUPERVISOR	1981-1982
DROVER – WAYNE RICHARD	SUPERVISOR & TRADESPERSON	1981-1982
DUCKWORTH – MICHAEL LAURENCE	TRADESPERSON	1978-1981
EHLERS – WAYNE EDWARD	TRADESPERSON	1980-1982
EMERY - PETER JAMES -	TRADESPERSON	1980-1981
FATT – LAURENCE ANTHONY	TRADESPERSON	1981-1982
FLYNN - SHAYNE THOMAS	TRADESPERSON	1980-1982
FORD - ANDREW KEITH	TRADESPERSON	1979
FRANCIS - KEVIN JOHN	TRADESPERSON	1980-1981
FRASER - IAN RAYMOND	TRADESPERSON	1981-1982
FREEMAN – MARK DANIEL	TRADESPERSON	1980-1981
GAWLEY - IAN JOHN	TRADESPERSON	1981
GEDGE – EDWARD JAMES	SUPERVISOR & TRADESPERSON	1980-1983
GILMORE – SAMUEL ROSS ALEXANDER	TRADESPERSON	1980
GRIFFITHS – JASON	TRADESPERSON	1981-1982
GROOBY – BARRY ANTHONY	TRADESPERSON	1977-1978
GUNNIS – FRANCIS WILLIAM	TRADESPERSON	1977-1981
HALL - JOHN CHARLES	TRADESPERSON	1979-1980

NAME	OCCUPATION	PERIOD
HASTIE – ARCHIBALD	BOILER ATTENDANT (DISPOSAL)	1979-1980
HAUCK - GARY THOMAS	TRADESPERSON	1979
HAYES - DAVID ALLEN	TRADESPERSON	1980-1982
HEMPSALL – ANDREW JAMES	SUPERVISOR & TRADESPERSON	1979-1980
HENSLER – BARRY JOHN	TRADESPERSON	1979
HERON - PHILLIP JOHN	TRADESPERSON	1981
HINSPETER – KEVIN FRANCIS	TRADESPERSON	1978-1979
HOUGHTON – ROBERT JAMES	TRADESPERSON	1978-1981
HUGHES – WAYNE MILTON	TRADESPERSON	1979-1980
JACKETT – STEVEN	TRADESPERSON	1978-1979
JEFFREY – ROBERT PAUL	TRADESPERSON	1982
JURGA – STEPHAN ROY	TRADESPERSON	1981-1983
KELSEY - ALISTAIR SIMON	TRADESPERSON	1981-1982
KENNETT - WILLIAM GEORGE	SUPERVISOR	1980-1981
KERR - GRAHAME DAVID	SUPERVISOR	1982
KORN - GREGORY JOHN	TRADESPERSON	1978-1979
LAKNER - JOHN JOSEPH	TRADESPERSON	1981
LAMBERT - DENIS CERIL	BOILER ATTENDANT (DISPOSAL)	1976-1981
LANDEMAN - ALLEN BRUCE CRAVEN	TRADESPERSON	1978-1979
LECINSKI - PETER	TRADESPERSON	1978-1979
LEHANE - DAVID WILLIAM	TRADESPERSON	1979- 1980
LUDGATER - MARK ANDREW	TRADESPERSON	1981-1982
MACKIE - PHILLIP SCOTT -	TRADESPERSON	1980-1981
MAKELA - IAN ARTHUR	TRADESPERSON	1979
MALLETT BARRY RALPH	BOILER ATTENDANT (DISPOSAL)	1976
MANNING PETER JOHN	BOILER ATTENDANT (DISPOSAL)	1975-1981
MARTIN - GREGORY PHILLIP	TRADESPERSON	1977-1978
MAXWELL - GAVIN THOMAS	TRADESPERSON	1981-1982
McCULLOCH - PAUL ANDREW	TRADESPERSON	1982
MEADOWS - ALAN WALTER	TRADESPERSON	1979-1980
METCALF - ALEX WILLIAM	TRADESPERSON	1979-1980
MIDDAP - LEIGH MAXWELL	TRADESPERSON	1982
MOTT- ANTHONY WILLIAM	TRADESPERSON	1981-1982
NEAL - WARREN DESMOND	SUPERVISOR	1979-1981
NIEL - WALTER	TRADESPERSON	1977-1980
NIELSEN - CHRISTY ROBERT	TRADESPERSON	1978-1979
OLSEN - ROSS COLIN	TRADESPERSON	1979-1982
PAINE - RICHARD THOMAS	TRADESPERSON	1977-1981
PANITZ - TERENCE MICHAEL	TRADESPERSON	1978-1980
PANNELL - CLIFF	TRADESPERSON	1979
PARKER - ROBERT JOHN	TRADESPERSON	1982
PARKER - TREVOR WAYNE	TRADESPERSON	1978
PARKES - IAN CHARLES	TRADESPERSON	1977-1980
PASHEN - DAVID JOHN	TRADESPERSON	1980-1981
PASLEY - MARK ANDREW	TRADESPERSON	1980-1981
PAYTON - MAXWELL RICHARD	TRADESPERSON	1978&1982
PERREN -RUSSEL KEITH	TRADESPERSON	1976-1983
PETERSON - MICHAEL JOHN	TRADESPERSON	1978-1980
PITMAN - DONALD JOHN	TRADESPERSON	1977-1978

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NAME	OCCUPATION	PERIOD
PRIESTLY - GARY BRUCE	TRADESPERSON	1979-1980
QUATERMASS - PETER MCDONALD	TRADESPERSON	1980
QUIRK - PATRICK	TRADESPERSON	1982
QUIRK - PATRICK MICHAEL	TRADESPERSON	1982
RAMSAY - COLIN JAMES	TRADESPERSON	1979-1980
RIGDEN - DOUGLAS WILLIAM BROWNING	SUPERVISOR	1980-1981
RIGLEY - RAYMOND	SUPERVISOR	1978-1979
ROBERTSON - JAMES JOHN	SUPERVISOR	1978-1979
ROBERTSON - PETER	TRADESPERSON	1979-1981
ROCHFORD - SHANE ARTHUR	TRADESPERSON	1979
ROMEYN - FREDERICK	TRADESPERSON	1981-1982
RUMSEY - PAUL EDWARD JOHN	TRADESPERSON	1979
RUPRECHT - MARTIN	TRADESPERSON	1978
SALLAWAY - TERRY CLIFFORD	TRADESPERSON	1977-1979
SARGENT - JOHN RICHARD	TRADESPERSON	1981-1982
SCHLEEMAN - JURGEN	TRADESPERSON	1982
SEYMOUR - RONALD	BOILER ATTENDANT (DISPOSAL)	1972-1979
SINCLAIR - MARK ANTHONY	TRADESPERSON	1980-1981
SINCLAIR - SCOTT ANDREW	TRADESPERSON	1979-1980
SJOSTEDT - JOHN FREDERICK	TRADESPERSON	1979
SOLOMONS - ROBIN GRANT	TRADESPERSON	1980-1981
SPENCER - BARRY REGINALD	TRADESPERSON	1981-1982
STEHBENS - BRIAN EDWARDS	TRADESPERSON	1979-1982
STRICKLAND - DAVID JAMES	TRADESPERSON	1980-1982
STUART - PAUL CAMPBELL	TRADESPERSON	1980-1981
SUNNERDALE - LEON MICHAEL	TRADESPERSON	1977-1979
TARRANT - ROBERT JAMES	TRADESPERSON	1979-1980
THIELE - WILLIAM JOHN MAXWELL	TRADESPERSON	1980-1982
TONKIN - THOMAS ARTHUR	TRADESPERSON	1979-1981
TOWNSEND - RAYMOND HERBERT	SUPERVISOR	1982
VESANDER - MARKKU OLAVI	TRADESPERSON	1981-1982
VICKERY - ALLAN ERNEST	BOILER ATTENDANT (DISPOSAL)	1978-1981
WARD - REGINALD ROBERT	SUPERVISOR	1979-1981
WARREN - MALCOLM EDWARD	TRADESPERSON	1976-1978
WATSON - GREGORY MARK	TRADESPERSON	1980
WEALE - JOHN JAMES	SUPERVISOR	1982
WEBSTER - RAYMOND JOHN	BOILER ATTENDANT (DISPOSAL)	1979-1980
WILSON - CLAYTON DREWE	TRADESPERSON	1981
WILSON - PAUL JAMES	TRADESPERSON & SUPERVISOR	1978-1979
WOODS - LEX LESLIE	TRADESPERSON	1980-1982
WUOTI - TREVOR JOHN	TRADESPERSON	1977-1982
YOUNG - BRUCE EDWARD	TRADESPERSON	1978-1979
YOUNG- IAN LESLIE	TRADESPERSON	1977-198

LIST OF POTENTIALLY EXPOSED PERSONNEL

2ND DESEAL/RESEAL PROGRAM

NAME	OCCUPATION	PERIOD
ADAMS - SAMUEL RAYMOND	TRADESPERSON	1991-1993
AMISS - ROGER PAUL	TRADESPERSON	1991-1993
ANDREWS – WILLIAM SCOTT	TRADESPERSON	1991-1992
APPLEBY – BRYAN WAYNE	TRADESPERSON	1991
ASHE – GREGORY JOHN	TRADESPERSON	1990-1992
BARNARD – KEITH	SUPERVISOR	1991
BARRETT – RICKY JAMES	TRADESPERSON	1991-1993
BAZZO - VIVIAN JOHN	TRADESPERSON	1992-1993
BETTERIDGE – HUGH CHARLES	SUPERVISOR	1991-1993
BOGGAN – MICHAEL ROWAN	TRADESPERSON	1991-1993
BRANDT – CHRISTOPHER JOHN	TRADESPERSON	1992-1993
COLLINSON – JOHN NICHOLAS	TRADESPERSON	1991-1993
D'ANDILLY – MICHAEL	TRADESPERSON	1991-1993
DAVIS - BRUCE ROBERT	TRADESPERSON	1991-1993
DAVISON – GARY	TRADESPERSON	
DEVENE - NEIL ROBERT	TRADESPERSON	1991-1993
DROVER – WAYNE RICHARD	SUPERVISOR & TRADESPERSON	1991
EDEN – RICHARD	TRADESPERSON	1990-1991
GODFREY – DAVID NOEL	TRADESPERSON	1991-1993
GODFREY – DAVID NOEL	TRADESPERSON	1991-1993
GODFREY - KAY ANN	TRADESPERSON	1991-1993
HALL - GRAHAME LESLEY	TRADESPERSON	
HALL - GRANT JOHN	TRADESPERSON	1991-1993
HOGER - JAMES ANDREW	TRADESPERSON	1991-1993
HUGHES – WILLIAM MACKIE	TRADESPERSON	1991-1993
IVERSEN – DALLAS	TRADESPERSON	
JESINOWSKI – DION ALEXANDER	TRADESPERSON	1991-1993
JOYCE - JOHN FREDERICK	TRADESPERSON	1993
LACK - DAVID JOHN	TRADESPERSON	1991-1993
MILES - CRAIG STEPHEN	TRADESPERSON	1991-1993
MUTZELBURG – BRADLEY GRAEME	TRADESPERSON	1991-1993
NEAL - LLOYD ROBERT	SUPERVISOR & TRADESPERSON	1991 & 1993
PAGE - JUSTIN DAVID	TRADESPERSON	1991 & 1993
PATTERSON – MAXWELL EDGAR	TRADESPERSON	1992-1993
SAGAIDAK – PAWEL	SUPERVISOR	
SAYWELL – MAURICE	SUPERVISOR	1991
SEIBEL - PHILIP JOHN	TRADESPERSON	1992-1993
SKINNER - PETER JOHN	TRADESPERSON	1991-1993
SMITH – ANTHONY	TRADESPERSON	
TAYLOR – DARRIN JOHN	TRADESPERSON	1989-1990
TINSLEY – THOMAS WILLIAM	TRADESPERSON	1991-1993
TUITE - DONALD MICHAEL	TRADESPERSON	1991-1993
TWINE – TERRY	TRADESPERSON	
VINER – RAYMOND GEORGE	SUPERVISOR	1991
WALKER – WILLIAM ANTHONY	TRADESPERSON	1990 & 1993
WHITE – STEVEN	TRADESPERSON	1990-1992

LIST OF POTENTIALLY EXPOSED PERSONNEL

WING PROGRAM

NAME	OCCUPATION	PERIOD
AIZLEWOOD – GREGORY HAROLD	SUPERVISOR	1985-1986
ALLEN - LINDA JOY	AWASCO	1990-1992
ALLEN - MICHAEL JOHN	SUPERVISOR & TRADESPERSON	1989-1991
ASHE – GREGORY JOHN	AWASCO	1990-1992
ASHTON - PETER STEWART	TRADESPERSON	1987-1989
BALASSA - DAVID ANDREW	TRADESPERSON	1989-1993
BARNARD - EDWARD	AWASCO	1989-1991
BARNES - STEPHEN STANLEY	TRADESPERSON	1992-1993
BARRETT - PAUL FRANCIS	SUPERVISOR	1986-1987
BEDDOES - RAYMOND MARK	TRADESPERSON	1987-1988
BELL - BARRIE JOHN	TRADESPERSON	1988-1992
BELL - HOWARD CLINTON	AWASCO	1990-1992
BELLOTT - ANDREW MARTIN	SUPERVISOR	1991-1995
BELLOTT - SUSSANNE GAYE	AWASCO	1991-1992
BERENTSEN - ANTON PAUL	TRADESPERSON	1986-1987
BOHR - RICHARD JAMES	TRADESPERSON	1983-1984
BUFFETT - CRAIG WILLIAM	TRADESPERSON	1985-1986
BURGE - SCOTT ANTHONY	TRADESPERSON	1985-1987
BUTCHER - CLAYTON JAMES	TRADESPERSON	1989
BUTCHER - RUSSELL WAYNE	AWASCO	1989-1991
CAMPBELL - MARK COLIN	TRADESPERSON	1989
CARRIER - CRAIG IRWIN	TRADESPERSON	1989-1990
CECERE - CLAUDIO CHRISTOPHER	SUPERVISOR	1987-1991
COATES - ROGER JOHN	SUPERVISOR	1984-1985
CONNELL - ROBERT	TRADESPERSON	1988-1990
COUCHMAN - ROBERT PAUL	TRADESPERSON	1992-1993
CROTHERS - ROBIN MICHAEL	TRADESPERSON	1992-1993
CULLEY - IAN	TRADESPERSON	1986-1987
DAUGHTREE - MALCOLM IAN	TRADESPERSON	1986-1988
DAVIDSON - ALLEN LEX	TRADESPERSON	1988-1992
DE VINE - BRANDON	TRADESPERSON	1993-1994
DENMAN - RICHARD SCOTT	TRADESPERSON	1986
DENSLEY - JEFFREY COLIN	TRADESPERSON	1993
DERBY - CATHERINE JANE	TRADESPERSON	1993-1994
DOCTOR - ALLAN	AWASCO	1991-1992
ELLIS - GARY STEPHEN	TRADESPERSON	1988-1989
EVANS - CHRISTOPHER	TRADESPERSON	1989-1990
EVANS - GRAHAM	TRADESPERSON	1988-1990
FERGUSON - JARROD LEIGH	TRADESPERSON	1993-1994
FINDLAY - NEILE JOHN	TRADESPERSON	1989
FORBES - RAYMOND	TRADESPERSON	1986-1990
FRANKE - MARK DOUGLAS	TRADESPERSON	1985-1987
FROST - JASON MICHAEL	TRADESPERSON	1992-1994
GATELY - ROBERT GEORGE PHILLIP	TRADESPERSON	1986-1987
GEDGE - EDWARD JAMES	SUPERVISOR	1990-1991
GLADWIN - STEPHEN ROBERT	TRADESPERSON	some time 84-87
GOODCHILD - JACQUELINE KIM	AWASCO	1990-1992

NAME	OCCUPATION	PERIOD
GRADY - KEITH JAMES	AWASCO	1989-1992
GRANT - ANDREW	SUPERVISOR	1989-1992
GREENSLADE - ANTHONY GEORGE	TRADESPERSON	1986
HADDON - SIMON ROBIN	TRADESPERSON	1985-1990
HARMER - GEOFFREY DONALD	TRADESPERSON	1989
HARRISON - TERRENCE VERDON	TRADESPERSON	1987-1988
HEMPSALL - ANDREW JAMES	SUPERVISOR & TRADESPERSON	1987-1990
HOUGHTON - ROBERT JAMES	SUPERVISOR	1978-1981
HUBBARD - RICHARD JOHN	TRADESPERSON	1989
HUNOLD - STEPHEN JOHN	TRADESPERSON	1989
HYLAND - NIGEL JOHN	TRADESPERSON	1990 - 1993
JACKSON - ERIC	TRADESPERSON	1992-1993
JAMES - ARTHUR ROSS	TRADESPERSON	1977-1978
JONES - GREGORY WAYNE	SUPERVISOR	1988-1990
JONES - JASON MICHAEL	SUPERVISOR	1996
KEHAGIAS - MICHAEL DAVID	TRADESPERSON	1989
KENT - GARY	TRADESPERSON	1993
KETCHELL - BRENDON NORMAN	TRADESPERSON	1989-1990
KING - PAUL DAVID	TRADESPERSON	1988-1989
KIRK - ROBERT WILLIAM	TRADESPERSON	1988-1990
KLARENBECK - GARY JAMES	SUPERVISOR	1986-1988
KNIGHT - RODNEY TREVOR	TRADESPERSON	1987-1990
KRAUSE - CRAIG ANDREW	AWASCO	1989-1992
LANG - LESLIE JAMES	SUPERVISOR	1991-1992.
LEONARD - KEVIN FRANCIS	AWASCO	1990-1992
LINDBURG - DAVID BRANT	TRADESPERSON	1984-1986
LYON - WAYNE ROBERT	TRADESPERSON	1989-1990
MAGNUSSON - JOHN LENNART	TRADESPERSON	1989
MAHER - WAYNE CHARLES	TRADESPERSON	1983-1986
MASSEY - MARK	TRADESPERSON	1989-1991
McANALLY - ALLAN EDWARD	TRADESPERSON	1987-1991
McDONALD - BRETT	TRADESPERSON	1985-1987
McGARRIGLE - KEVIN WILLIAM	TRADESPERSON	1989-1990
McLEAN - NEVILLE RONALD JAMES	TRADESPERSON	1984-1986
MILLIS - ROBIN JAMES	TRADESPERSON	1991-1993
MIRALLEZ - MICHEL	SUPERVISOR & TRADESPERSON	1991-1992
MOLLOY - JEFFREY PETER	AWASCO	1989-1992
MOLLOY - NORMAN CHARLES	AWASCO	1989-1992
MORAN - LEON ROBERT	TRADESPERSON	1985-1986
MORRELL - ANDREW DAVID	TRADESPERSON	1989-1990
MORROW - GLEN ANTHONY	TRADESPERSON	1986-1987
MOSS - PAUL JAMES	TRADESPERSON & SUPERVISOR	1988-1990
NIELSEN - NATALIE	AWASCO	1991-1992
NORTHOVER - CRAIG STEVEN	TRADESPERSON	1986-1989
NOWLAN - LUKE MICHAEL	TRADESPERSON	1985-1987
OWERS - JEFFREY	TRADESPERSON	1992
PAGETT - NIGEL DOMINIC	TRADESPERSON	1989
PAINE - LORELLE	TRADESPERSON	1992-1993
PARTRIDGE - COLIN EDWARD	SUPERVISOR & TRADESPERSON	1989-1990
PATTERSON - ALAN	TRADESPERSON	1986-1989

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NAME	OCCUPATION	PERIOD
PEACOCK - NIGEL KEITH	TRADESPERSON	1992-1993
PFEFFER - BRETT CAMERON	AWASCO	1989-1992
PIKE - JEFFREY WILLIAM	TRADESPERSON	1993-1994
PORTER - RUSSELL JOHN	TRADESPERSON	1985-1988
POULSEN - PAUL RONALD	TRADESPERSON & SUPERVISOR	1993
RODWAY - MARK TIMOTHY	TRADESPERSON	1988-1990
SAGAIDAK - PAWEL	SUPERVISOR	1991-1992
SAVILLE - TIMOTHY JOHN	TRADESPERSON	1988-1989
SCOTT - GEORGE DUNN	AWASCO	1989-1992
SEIBEL - PHILIP JOHN	TRADESPERSON	1984-1989
SIMMICH – RAYMOND ARTHUR	TRADESPERSON	1983-1985
SMITH – RODERICK EARNEST	TRADESPERSON	
SPALDING – MICHAEL ROYCE	TRADESPERSON	1983-1986
SPARROW – SIMON VINCENT JAMES	SUPERVISOR & TRADESPERSON	1988-1990
STARK - CLINTON TROY	TRADESPERSON	1993
STEWART - CARL ANTHONY	AWASCO	1989
STOWER - GAVIN JEFFREY	TRADESPERSON	1983-1984
STYLES – RONALD LESLIE	AWASCO	1989-1991
SUTHERLAND – JOHN RODERICK	TRADESPERSON	1993
TAYLOR – DUNCAN KEITH MORGAN	SUPERVISOR & TRADESPERSON	1990-1991
TAYLOR – RONALD DEAN	TRADESPERSON	1986
TAYLOR – WALTER WILLIAM	SUPERVISOR & TRADESPERSON	1986-1990
THORPE - PETER JAMES	TRADESPERSON	1990-1991
TIBBEY - GLEN DAVID	TRADESPERSON	1984
TRELEAVEN – DANIEL BYRON	TRADESPERSON	1993
TREWICK – ANTHONY LYLE	AWASCO	1989-1992
TUCKER – ROBERT JAMES	TRADESPERSON	1985-1987
TUITE - DONALD MICHAEL	SUPERVISOR	1984-1989
TUNGATE - ROY WILFRED	SUPERVISOR	1986-1987
VESANDER – MARKKU OLAVI	TRADESPERSON	1982-1986
VINCENT - ALAN STUART	TRADESPERSON	1985-1987
WAIT - GREGORY PAUL	TRADESPERSON	1987-1988
WALLIS - JAMES	TRADESPERSON	1988
WHEELER - PHILLIP WILLIAM	AWASCO	1989
WHEELER - STEVEN WAYNE	TRADESPERSON	1989
WILLCOX - STEVEN PAUL	TRADESPERSON	1989
WRIGHT - ASHLEY TODD	AWASCO	1991-1992
WRIGHT - DOUGLAS WAYNE	AWASCO	1989-1992
WYKES - LENARD THOMAS	SUPERVISOR	1987-1988
ZUGNO - OSCAR ROBERTO	TRADESPERSON	1988-1990

LIST OF POTENTIALLY EXPOSED PERSONNEL

SPRAY SEAL PROGRAM

NAME	OCCUPATION	PERIOD
ALLEN - CARL DAVID	SUPERVISOR	post 1996
ANDERSON – SHAWN PATRICK	SUPERVISOR	post 1996
BEAL – ALICIA	TRADESPERSON	1999
BENNETT – GREGORY RONALD W.	SUPERVISOR	1996
BROWN – ROBERT REID	TRADESPERSON	1996-1997
BURLEY – VANESSA MICHELLE	SUPERVISOR	
CARMODY – GLEN STEWART	SUPERVISOR	1994
COOK - DEAN ASHLEY	TRADESPERSON	
COTTER - SEAN PATRICK	TRADESPERSON	1993
DIXON - ADRIAN STUART	TRADESPERSON	1996
DOCKSEY – BRETT JAMES	TRADESPERSON	1997
FENECH - MARK STEVEN	TRADESPERSON	1997
FISHER - SCOTT EVERETT	TRADESPERSON	post 1996
FROHLOFF – BRADLEY JOHN	TRADESPERSON	1998
GALLAGHER – GRAHAM PHILLIP	TRADESPERSON	post 1996
GIBSON - BRETT A.	TRADESPERSON	
GRANT - STEVEN DOUGLAS	TRADESPERSON	1997
JOINER - HEATH ASHLEY	TRADESPERSON	1996
JONES - JASON MICHAEL	SUPERVISOR	
KENNEDY – WILLIAM ALEXANDER	TRADESPERSON	1995
LAWRIE – BRIAN	TRADESPERSON	
MARTIN – BRADLEY PETEY	SUPERVISOR	
McCLYMONT – WILLIAM HUGH	TRADESPERSON	1996
MILLS - LEIGH ROBERT	SUPERVISOR & TRADESPERSON	1999
MOHAPP - SEAN ALBERT	TRADESPERSON	1997
O'CONNOR – RODNEY	SUPERVISOR	
O'CONNOR – RODNEY	SUPERVISOR	
OHMSEN – GEOFFREY JAMES	TRADESPERSON	1994-1999
ORWIN - MARK WILLIAM	SUPERVISOR	1997-1999
PARKER – CHETWYN JOHN ANTHONY	TRADESPERSON	
PELIZZARI – JOHNATHON JAMES	SUPERVISOR	
PLEKKER – RAY	SUPERVISOR	
PROSSER – GREGORY RAYMOND	SUPERVISOR	
RALPH - SEAN KEITH	TRADESPERSON	1998
RUTH - PETER JOHN	TRADESPERSON	1999
SAUNDERS – DEAN ANDREW	TRADESPERSON	
SPIES - KEVIN ANDREW	TRADESPERSON	1999
TREWIN - ADAM RUSSELL	TRADESPERSON	1998
WEATHERBY – KEITH MARK	TRADESPERSON	1997

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NON PROGRAM PEOPLE AND DATES ASSOCIATED WITH DESEAL / RESEAL WORK

NAME	OCCUPATION	PERIOD
ABURN – ALLAN DAVID ROBERT	TRADESPERSON	1974 1979
ABURN - KEVIN GREGORY	TRADESPERSON	1985-1997
ACE - BRETT WAYNE	TRADESPERSON	1990
ALECKSON – PHILIP JOHN	SUPERVISOR	1990-1991
ALEXANDER GREGORY ROYCE C.	TRADESPERSON	1993
ALLEN - MICHAEL JOHN	TRADESPERSON & SUPERVISOR	1989
ALLEN - TREVOR GEORGE	SUPERVISOR	1988-1990
AMOS - RODNEY LLOYD	TRADESPERSON	1988
AMUNDSEN - WARREN JOHN	TRADESPERSON & SUPERVISOR	1995
ANDERSON - JOHN	TRADESPERSON	1993
ANSON - ANTHONY NEIL	TRADESPERSON	1989-1990
BAKER - TIM	SUPERVISOR	1990-1991
BALDWIN - TANYA LOUISE	TRADESPERSON	1989
BALDWIN - TERRY	TRADESPERSON	1989-1991
BANNISTER - DEREK CHARLES	SUPERVISOR	1990, 1992, 1993
BARNARD – EDWARD	TRADESPERSON	1989-1991
BARNES - STEPHEN STANLEY	TRADESPERSON	1992-1993
BEALE - ROSS ALEXANDER	SUPERVISOR	1987-1989
BERENTSEN – ANTON PAUL	TRADESPERSON	1986-1987
BISSETT - RAYMOND JOHN	NON-PROGRAMME	1996-1998
BLACKA - LAURENCE PATRICK	TRADESPERSON	1986-1989
BLACKA – LAURENCE PATRICK	TRADESPERSON	1986-1989
BOHR - RICHARD JAMES	TRADESPERSON	1983-1984
BRADY - HANIDA MAU	TRADESPERSON	1984
BRAND - JASON CHRISTOPHER	TRADESPERSON	1992
BRIESE - PETER GEORGE	SUPERVISOR	1992-1993
BRIGNELL – BENJAMIN O'CONNELL	TRADESPERSON	1989
BROWN - ALLAN ARTHUR	TRADESPERSON	1982-1983
BRUNNE - NOEL RUSSELL	SUPERVISOR	1988
BUTLER - NOEL IAN	TRADESPERSON	1997-2000
BYRNES - FRANK GEORGE	TRADESPERSON	
CANNAN - GREGORY EDWARD	SUPERVISOR	1984-1990
CAPPER - WILLIAM ANTHONY	SUPERVISOR	1988
CARRIER - CRAIG IRWIN	TRADESPERSON	1989-1990
CHOICE - MARK ANDREW	TRADESPERSON	early 90's, 97, 98
CLARK - CHRISTIAN ALEXANDER	TRADESPERSON	1993
COLLIER - NICHOLAS JOHN	TRADESPERSON	1988-1990
CONNELL - ROBERT	TRADESPERSON	1988-1990
COX-NORMAN - BARRY	TRADESPERSON	1983-1986
DAVIDSON - ALLAN	TRADESPERSON	1975-1986
DENSLEY - JEFFREY COLIN	TRADESPERSON	1993
DERBY - CATHERINE JANE	TRADESPERSON	1993-1994
DILLON-SHALLARD- DAVID BRUCE	TRADESPERSON	1990-1991
DIX - TREVOR WARREN	TRADESPERSON	1989
DOPSON - JEFFREY ALAN	TRADESPERSON	1983-1984
DOWDEN - CHRISTOPHER	TRADESPERSON	1973-1989
EGGMOLESSE - VERNON JOHN	TRADESPERSON	1982
ELVIN - GRAHAM THOMAS	TRADESPERSON	1985-1987
EYRE - PAUL WALLACE	TRADESPERSON	1989-1990
FINDLAY - NEILE JOHN	TRADESPERSON	1989
FLEMING - PETER JAMES MAUGHAN	TRADESPERSON	1985-1989

NAME	OCCUPATION	PERIOD
FRANZI - ROSS ERNEST	TRADESPERSON	1985-1986
GEDGE - EDWARD JAMES	TRADESPERSON & SUPERVISOR	1982-1983
GRIMMETT - RUPERT	TRADESPERSON	post 1996
GROSSER - KYMPTON DENIS	TRADESPERSON	1994-1996
GURMAN - DAVID JOHN	TRADESPERSON	1998
HALLORAN - CLAYTON JONATHON	TRADESPERSON	1995-1996
HARRISON - DAVID	TRADESPERSON	
HARRISON - TERRENCE VERDON	TRADESPERSON	1987-1989
HOLMES - SCOTT ANTHONY	TRADESPERSON	1989
JACOBSON - RICHARD	TRADESPERSON	1986-1987
JOC - STEVEN ANTHONY	TRADESPERSON	1988-1998
JONES - DAVID JAMES	TRADESPERSON	1984-1985
JONES - GREGORY WAYNE	SUPERVISOR	1989-1991
JONES - JASON MICHAEL	SUPERVISOR	
JONES - JASON MICHAEL	TRADESPERSON	1996
KEHAGIAS – MICHEAL DAVID	TRADESPERSON	1989
KENNEDY - JOHN ANDREW	TRADESPERSON	1990-1993
KIDD - WARREN NORMAN	TRADESPERSON	1987 to date
KUSSROW - MARK LESLEY	TRADESPERSON	1982-1985
LAKNER - JOHN JOSEPH	TRADESPERSON	1991-1993
LANG - LESLIE JAMES	SUPERVISOR	1977
LEGGATT - PETER MICHAEL	TRADESPERSON	1989-1992
LIETZOW - KENNETH ROSS	TRADESPERSON	1984-1985
LIPPINKHOF - STEPHEN DAVID	TRADESPERSON	late 80's early 90's
LIVINGSTONE - IAN	TRADESPERSON	1986
MADSEN, ROBERT BRUCE	SUPERVISOR	1987-1989
MASSEY – MARK	SUPERVISOR & TRADESPERSON	
MAXWELL - DAVID RONALD	TRADESPERSON	1984-1986
McDONALD – BRETT	TRADESPERSON	1985-1987
McGARRIGLE - KEVIN WILLIAM	TRADESPERSON	1989-1990
MEDVED - IVAN	SUPERVISOR	1994-1996
MICALLEF - GINO	TRADESPERSON & SUPERVISOR	1989-1990
MORRELL – ANDREW DAVID	TRADESPERSON	1989-1990
MORRIS – ANDREW KEITH	TRADESPERSON	1987-1989
MOSS - PAUL J	TRADESPERSON & SUPERVISOR	1988-1990
MURPHY - SHANE TERENCE	TRADESPERSON	1994
MURRAY - GERARD ANTHONY	TRADESPERSON	1989-1993
MYLREA - CRAIG CHARLTON	TRADESPERSON	1988-1990
MYLREA - CRAIG CHARLTON	TRADESPERSON	1988-1990
NAPPER - STEPHEN ERIC	TRADESPERSON	
NASH - CHRISTOPHER JOHN	TRADESPERSON	1995-1997
NEVIN - PAUL WILLIAM	TRADESPERSON	1989-1991
NEVIN - PAUL WILLIAM	TRADESPERSON	1989-1991
NEWALL – STEVEN JOHN	TRADESPERSON	1989
NORTHEY – BRETT ANTHONY	TRADESPERSON	1989
NOWLAN - LUKE MICHAEL	TRADESPERSON	1985-1987
OLSEN - SCOTT JOHN	TRADESPERSON	1989-1990
ORWIN - MARK WILLIAM	SUPERVISOR	1997-1999
PAINE - LORELLE	TRADESPERSON	1992-1993
PARKER - GARY DOUGLAS	SUPERVISOR	1988
PAWLENKO – SHAYNE MICHAEL J.	TRADESPERSON	1989-1990
PEACOCK - NIGEL KEITH	TRADESPERSON	1993

NAME	OCCUPATION	PERIOD
PERRY - JAMES ANTHONY	TRADESPERSON	1989
PIPER - MICHAEL JOHN	TRADESPERSON	1997
PLEWS - BRADLEY PHILLIP	TRADESPERSON	1989
PODBURY – SHAUN	TRADESPERSON	1989-1990
POULSEN - PAUL RONALD	TRADESPERSON	1993
QUALISCHEFSKI - VANESSA MARIE	TRADESPERSON	1992-1993
REEVES - DREW WARREN	TRADESPERSON	1992-1996
RICKETTS - JOHN DOUGLAS	TRADESPERSON	1998-1999
RIGGS - RONALD WAYNE	TRADESPERSON	1997
ROGERS - ALLAN WALTER	TRADESPERSON	1990 & 1993
ROONEY - MARK ANDREW	TRADESPERSON	1982
ROSE- OWEN VICTOR	TRADESPERSON	1998
ROSS - DAVID THOMAS	TRADESPERSON	1989
ROSSITER - MATTHEW ALLEN	TRADESPERSON	1994-1995
RYAN - JEFFREY JAMES	TRADESPERSON	1986
RYAN - PAUL JEREMY	SUPERVISOR	1990-1991
RYBARCZYK - BERT ERIC	TRADESPERSON	1991-1992
SANDHAM - CHARLES	SUPERVISOR	1994
SILLENCE - DERRICK THOMAS	TRADESPERSON	1988
SPENCER – BARRY REGINALD	TRADESPERSON	1981-1982
STALLARD - NEIL WILLIAM	TRADESPERSON	1983-1985
STARK - CLINTON TROY	TRADESPERSON	1993
STEART - SCOTT ANTHONY CLIFFORD	TRADESPERSON	1997
STEWART - CARL ANTHONY	TRADESPERSON	1989
THOMAS - ROSS JAMES	TRADESPERSON	1989
THOMSON - DAVID JON MCGREGOR	TRADESPERSON	1987-1988
TRIEBE - CHRISTOPHER FREDERICK	TRADESPERSON	1984-1986
TUITE - DONALD MICHAEL	TRADESPERSON	1976-1979
WATSON - TERRY JAMES	TRADESPERSON	1991-1993
WHITE - BRETT JOHN	TRADESPERSON	1983-1985
WHITTON - BARRY	TRADESPERSON	
WILLIAMSON - MARK	TRADESPERSON	1988-1989
WOODHOUSE - PHILIP	TRADESPERSON	198-1989
WOOLACOTT - KIM RUSSELL	TRADESPERSON	1995
WOUTI - PETER JAMES	TRADESPERSON	1988
WRIGHT - DOUGLAS WAYNE	TRADESPERSON & SUPERVISOR	1989-1992
YARROW - MICHAEL HERBERT	TRADESPERSON	1985-1987
ZUGNO - OSCAR ROBERTO	TRADESPERSON	1988-1990

CHAPTER 13 – MEDICAL

INTRODUCTION

13.1. Two Terms of Reference (TOR), namely TOR 3.a.(11) and TOR 3.b.(2), directly raise medical issues. TOR 3.b.(2), reproduced in full below, calls for the identification, investigation and reporting on the nature and extent of health complaints and treatment provided concerning health complaints possibly resulting from DR procedures, including health monitoring. TOR 3.a.(11) addresses the state of medical and scientific knowledge regarding DR chemicals from time to time. Other TORs indirectly address medical issues, for example, TOR 3.a.(7)- OH&S approvals, processes and management structures and TOR 3.a.(12) - systemic issues that should be addressed.

13.2. The medical issues to be addressed in this chapter are:

a. the nature and extent of health complaints;
b. health monitoring;
c. the state of medical and scientific knowledge;
d. the state of RAAF personnel and medical records;
e. other systemic issues identified by specialist witnesses (including the effects of ADF/RAAF health reorganisation); and
f. recommendations of specialist witnesses.

NATURE AND EXTENT OF HEALTH COMPLAINTS

Term of Reference

13.3. TOR 3.b.(2):

a. "the nature and extent of health complaints reported as resulting from exposure to chemicals used in the DR procedures of those personnel identified above and the treatment provided; if there was any health monitoring of these personnel, detail any preventative action taken as a result of health monitoring"

Methodology

13.4. The evidence concerning the nature and extent of health complaints was derived from witness narrative statements; witness health questionnaires; RAAF staff files and individual medical records.

13.5. A medical aviation/occupation medicine specialist, Dr Eric Donaldson, was retained to analyse the data collected and to produce a report addressing, primarily, the nature and extent of health complaints. Dr Donaldson consulted a leading hepatologist, Professor W G E Cooksley to report on the specific issue of abnormal liver function tests and blood examinations revealed through the medical record search. The provision of reliable and relevant data for analysis by these specialists was made extremely difficult due to the poor state of medical records. A copy of Dr Donaldson's Report, including the report of Prof. Cooksley, is at Annex A.

Nature and Extent of Health Complaints - Dr Donaldson's Report

13.6. Methodology. Dr Donaldson’s report was primarily based on an examination of the documents (narrative statements, health questionnaires and medical records) of 110 persons of a total of 662 persons identified in the BOI's records at the time as being possibly exposed to chemicals in the DR programs. The reason for the number analysed related to the difficulty in identifying from RAAF records accurately and reliably when persons served on the DR programs and hence their periods of possible exposure. However, Dr Donaldson reports that as the selection process for the 110 appeared to be without bias and as it covered approximately one-sixth of the total population exposed, that there is no reason to suspect that this Group is not representative of the total Group. The list of health complaints derived from the health questionnaires is given at Annex B with a summary table showing the number of people making claim. Those who have made formal claims are identified in Annex C although with all of these claims can be said to be related to the effects of chemical exposure.

13.7. Dr. Donaldson's Conclusions. Key conclusions in Dr Donaldson's Report are contained in an Executive Summary at the beginning of the Report.[1] The following conclusions are highlighted:

a. that a number of medical complaints could be attributed to a chemical cause;[2]

b. that there appeared to be no consistent pattern in the medical records of biological monitoring for chemical exposure during the majority of the Deseal/Reseal programs; and

c. that any comment on the short or long-term toxic effects of possible exposure to chemicals used on the Deseal/Reseal Programs could only be made after a rigorous case controlled study[3].

13.8. Prof Cooksley's Conclusions. Prof Cooksley was provided with copies of all abnormal liver function tests and abnormal full blood examinations contained in the medical records of the 110 persons. Prof Cooksley's Report is at Enclosure 4 to Dr Donaldson's Report. It included the following:

a. 'A substantial no. of individuals had abnormalities … In conclusion, one could say it is entirely possible all these abnormalities reflected physiological variation and intercurrent disease in the community. On the other hand, it is possible only a proportion has such an explanation and there has been toxin-induced damage. Although it is likely that any such damage is mild and transient that could not be stated confidently without biopsy. To clarify some the following could be carried out, (i) retrospective analysis of a comparable group's medical records to see whether the frequency and pattern is the same and, (ii) a prospective study with a formal protocol of liver function in people carrying out this type of work.[4]'.

Nature of Health Complaints - Report of WGCDR Ross

13.9. WGCDR James Ross, an occupational medicine specialist, prepared an interim report in April 2000 for the 501WG spray sealing investigation[5]. As part of his investigation, WGCDR Ross compared the health profiles of members of FTRS in early 2000 with another group at Amberley.

13.10. WGCDR Ross reported that the major finding is that 'there are 14 FTRS workers out of 30 reviewed who have reported to medical flight with symptoms consistent with chemical exposure. There is also an excess of self-reported symptoms in the "exposed" group of workers, compared to a "non-exposed" group. The weight of evidence at this stage is sufficient to advise the workers and the regulatory agency (COMCARE) that workers have been adversely affected by the spray sealing operation.[6]' WGCDR Ross had also cautioned

1 EXP.0003.001 (at 003), Dr Eric Donaldson OAM, Nature and Extent of Health Complaints at page 3.
2 Transcripts\MAR21.DOC - DONALDSON See also the transcript of Dr E Donaldson; 21 Mar 01 at page 52.
3 Transcripts\MAR21.DOC - DONALDSON See also the transcript of Dr E Donaldson; 21 Mar 01 at page 52.
4 EXP.0003.001 (at 029), Prof W G E Cooksley, Review of Laboratory Abnormalities in Defence Staff Working on Tank Cleaning Programs.
5 EXP.0001.001, WGCDR Ross Report, Executive Summary.
6 EXP.0001.001, WGCDR Ross Report, Executive Summary.

as follows: 'I have provided a number of findings and recommendations. These should be seen as interim only, as they require considerably more information and evaluation than has been possible to date. [7]'

13.11. Also in correspondence of 22 Mar 2000, WGCDR Ross stated:

a. " … I am now satisfied that there has highly likely been human exposure to hazardous chemicals in that workplace. I am also satisfied that a number of personnel have demonstrated symptoms consistent with exposure to the chemicals used in that workplace…I consider there is presumptive evidence of a linkage between the symptoms described, and workplace exposure…(However) awaiting more information as part of this investigation …thus a complete report will only be available in concert with the rest of the investigation. I cannot exclude the possibility that in the end the symptoms are not found to be due to chemical exposure.[8]"

Department of Veteran Affairs Study

13.12. A number of experts including Dr Donaldson and Prof Cooksley emphasised that given the nature of the chemicals involved in the DR programs an epidemiological study would be needed to determine whether medical complaints were linked to the DR workplace. The Department of Veteran Affairs, in what is a joint project with the Department of Defence has contracted such a study. The Terms of Reference for the study are at Annex D.

13.13. The Medical Services Adviser to the Department of Veterans Affairs in Canberra, Dr W.A. Horsley, gave oral testimony before the BOI on 22 Mar 01 concerning the study. Regarding the timeframe for completion of the study Dr Horsley indicated that one of the Terms of Reference involved investigating neurological deficit, which, due to its demanding nature could take from eighteen months to two years to complete. Other parts of the study, however, could reportedly be completed earlier[9]. Dr Horsley informed the BOI that it might be possible for a claimant to establish an individual casual link notwithstanding the study's findings.[10]

HEALTH MONITORING

Methodology

13.14. TOR 3.b.(2) provides for the identification, investigation and reporting on, amongst other medical issues, the health monitoring of personnel. Information on this issue was collected from:

a. the identification of the RAAF regulatory framework regarding health monitoring from time to time;

b. a search of RAAF staff files to determine policy concerning health monitoring and to provide evidence of health monitoring conducted;

c. a search of selected members medical files (the same as for Dr Donaldson's research project) to provide evidence of health monitoring conducted; and

d. the examination of witness statements and transcripts, including those of Medical Officers and higher management, to provide evidence of policy regarding health monitoring and health monitoring conducted.

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7 EXP.0001.001, WGCDR Ross Report, Executive Summary.

8 501WG 704/1/8/P1 Part 1(3) dated 22 Mar 00. Reported in HRG.0001.001 (at 012), Statement of GPCAPT R J Sargeant at pars 50-51.

9 Transcripts\MAR21.DOC - HORSLEY , Transcript of K W A Horsley; 22 Mar 01 at page 3.

10 Transcripts\MAR21.DOC - HORSLEY2, Transcript of K W A Horsley, 22 Mar 01 at page 6.

Health Monitoring - Prescribed Requirements

13.15. AAP 7214.003-292-3. The requirements for health monitoring prescribed by the RAAF varied in authority and specificity during the period of the programs. The greatest clarity was during the first program with the requirements for base line and annual monitoring as well as monitoring on ceasing deseal/reseal work being prescribed in AAP 7214.003-292-3 issued in December 1979. It required:

a. "Before commencing actual deseal/reseal work:
   (1) pulmonary function test;
   (2) complete urinalysis;
   (3) audiogram, and
   (4) liver function program.

b. Every 12 months, or on ceasing deseal/reseal work:
   (1). to (4) of a. above and
   (2). full blood count."

13.16. Effect of the Removal of SR51. There was doubt as to the applicability of AAP 7214.003-292-3 to the wings program and in any case the version of the AAP 7214.003-292-3 issued on 13 Sep 90 removed the requirement for health monitoring, reflecting the removal of SR51 as a chemical desealing agent. For programs other than the first DR program there was thereafter periodic doubt as to the detailed requirements for health monitoring of RAAF personnel involved in DR tasks. There was no policy during the period of investigation of the BOI after 1990 that made health monitoring mandatory for DR personnel. Such requirements were established at base level. Also, prior to the formal amendment of AAP 7214.003-292-3 but after the removal of SR51 from the deseal/reseal process there was questioning of the requirement.

13.17. During 1988 there was questioning as to the requirement for health monitoring of personnel involved in deseal/reseal activities. The outcome was that monitoring was to continue[11].

> 'Personnel engaged in the deseal/reseal operation at RAAF Amberley are to have an annual occupational health examination. This will be performed in two (2) stages as follows:
>
> (1). Stage 1: Personnel will be interviewed by occupational health staff to determine any unusual exposures throughout the years. Occupational health staff will complete form PM112 (special examination request) for the following tests:
>
> (a). FBP, LFTS, Serum Creatinine, urine analysis
>
> (b). Occupational health staff will ensure that an appointment is made for each individual with a medical officer for a time no less than one (1) week and no more than two (2) weeks following this stage one (1) exam.
>
> (2). Stage 2: Personnel will be reviewed by a Medical Officer who will determine the presence or absence of any skin, liver, renal, haematological or neurological disorders resulting from occupational exposure. The Medical Officer will make an entry in the PM126 (personal medical records) concerning the result of his/her determination. Any adverse findings will result in appropriate medical administrative and environmental health action being taken.

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11 Minute to MO's ENVHO and information HQOC (PMO) from SMOWGCDR MP Hubble; 5 Sep 88.

(3). Environmental health personnel will ensure that appropriate EDP action is taken to facilitate annual recall of all deseal/reseal personnel.'

13.18. 1988 - DI(AF)PERS 53-4 - Occupational Health Assessments. In 1988 DI(AF) PERS 53-4 - Occupational Health Assessments, addressed health monitoring but left it to the discretion of SMOs as to what monitoring was conducted. The Director Joint Health Support Agency advised that DI(AF)PERS 53-4 remains current at the time of the BOI sittings.[12]

Particular areas of interest are:

a. Par 5. 'OHAs consist of three main parts: a. evaluation of working areas to determine the nature and extent of personnel exposure to any hazard; b. a medical officer assessment when indicated; and c. additional investigation as required.'

b. Par 6. '(SMOs) or their representatives are to: evaluate working areas known or suspected to be hazardous and determine the risk and degree of exposure to personnel during normal operations or following any incident or accident.'[13]

13.19. 1990 - DI(AF)PERS 56-15 -Occupational Health and Safety. Evaluation and Control of Workplace Hazards. This was promulgated in 1990 and included the following:

a. Par 31. 'The aim of an occupational health assessment (OHA) is to determine if a job or task is having an effect, or is likely to have an effect, on the health of an individual. OHA's are to be conducted on the advice of the SMO when:

(1). personnel have accidentally been exposed to hazardous materials, and

(2). the SMO considers that there is a likelihood of a hazard affecting the health of an individual.'

b. Par 32. 'An OHA should include the evaluation of a member's workplace to determine the presence of hazards and the level of their control. An OHA may also include: a. a medical examination, and/or b. any other assessments as required.'

c. Par 34. 'Biological monitoring of personnel exposed to hazards has a limited role as a hazard control option. Biological monitoring should only be used where specific biological tests exist which can determine relationships between hazard exposure and biological changes, and when it is the only appropriate method of determining the adequacy of the hazard control measures.'[14]

13.20. 1994 - Requirement for Annual OHA. In a Minute dated Oct 94 the OIC HSF 301 ABW at Amberley (the SMO) reported to units at Amberley regarding the requirements for OHAs for various work areas and musterings. For the 'Reseal/Deseal Process' it was stated that the requirement was for “annual examination (May).[15]

13.21. 1998 - Requirement for Annual OHA. In a Minute from the FSGT EHSURV to the Team Leader ARRS the requirement for Occupational Health Assessment for FTRS was reviewed. It refers to a request for the appropriate frequency of OHAs for FTRS personnel to be determined by EHS. It states that OHAs are required for personnel who have been identified as having significant risk to health; exposure to hazardous substance for which

12 EXP.0010.001 (at 004), Statement of Andrew Geoffrey Robertson at pars 11-16.
13 DI(AF)PERS 53-4, "Occupational Health Assessments"; 1 Aug 90.
14 DI(AF)PERS 56-15. Occupational Health and Safety. Evaluation and Control of Workplace Hazards; 1 Jul 90.
15 AMB.0029.021, WGCDR Dugdale Minute 301 ABW/1804/12/4/Med Pt 2 (26); Oct 94.

there is a reasonable likelihood that disease or health effect may occur; or identifiable diseases or health effects that may be related to exposure. OHAs may also be required following incidents or accidents that may result in individual exposures to hazardous agents. Reportedly, prior to this advice there was no standing requirement for routine OHAs for FTRS. The RAAF Amberley Medical Flight SOP that provided for annual OHA was under review. It was stated that the new SOP would not require annual OHA if correct PPE was worn and chemical handling was carried out IAW MSDS. However, it was suggested that, while concerns from FTRS personnel remain, OHA be conducted on an annual basis. A copy of the suggested 301HSF SOP 39 was enclosed (at IOI.0016.373).[16] (A copy of 301HS SOP 39 current in May 98 and providing for annual OHA for FTRS personnel is at AMB.0029.033.)[17]

13.22. AAP 7214.003-2-1. Although outside the period of investigation of the BOI, the Board notes that in September 2000 the Air Force issued Annex F to Chap 5 of AAP 7214.003-2-1 concerning medical requirements for fuel tank employment. It includes detailed provisions for biological monitoring. This amendment was one of the consequences of the work of the 501WG IO, which was directed at the development of safe fuel tank entry procedures.

Responsibilities for Health Monitoring

13.23. DGAFHS. DI(AF)PERS 51-2 provides that DGAFHS responsibilities include:

a. At para 2.a ' …monitoring and providing continuing advice on the medical fitness of RAAF personnel for continued employment.'

b. At para 2.c.(3) 'occupational health measures including the control of physical and chemical health hazards and medical aspects of ground safety.'

13.24. SHO/PMO. DI(AF)PERS 51.4 (8 Sep 95) provides at para 1 that 'The Senior Health Officer (SHO) and Principal Medical Officer (PMO) are responsible to the Director-General of Air Force Health Services (DGAFHS) for the following:

a. 'technical and professional supervision of elements of the Health Services within the Command.'[18]

Evidence of Monitoring Conducted/Not Conducted

13.25. An attempt was made to determine the nature of the RAAF health monitoring programs actually conducted by reference to primary sources. However, a search of RAAF documents, including RAAF medical staff documents, did not provide a comprehensive picture of what health monitoring was actually conducted over the period of the DR programs. Nor did a search of individual medical files as is reported later in this Chapter. The result of the search of RAAF staff files indicates there is little documentary evidence of health monitoring conducted during the first DR program, reasonable evidence of a health monitoring program during the wings program and incomplete information concerning the spray sealing program. Whether these gaps reflect gaps in documentation or gaps in the conduct of health monitoring programs is not clear.

13.26. Witness statements were also a source of information concerning health monitoring conducted but due to passage of time can be considered a secondary source. Witness statements for the first program reveal some evidence of there being a health monitoring program but little evidence of actual health monitoring conducted[19]. For the wings program there is extensive evidence of health monitoring being conducted although there appears to

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16 IOI.0016.371.

17 AMB.0029.033, Occupational Health Assessment OHA Requirements dated 1 May 98

18 DI(AF)PERS 51-4 of 8 Sep 95. Responsibilities of Principal Medical Officer/Senior Health Officer and Senior Medical Officers.

19 WIT.0171.001, Witness Statement of ML Kussrow at par 32

have been inconsistent application to individual workers[20]. The spray sealing program witness statements provide evidence of a health monitoring program being in place but also a questioning of its adequacy and the capabilities and responsiveness of Medical Flight[21].

13.27. The Hawker de Havilland program did provide evidence of a comprehensive health monitoring program.

Health Monitoring - Dr Lewis' Report

13.28. A medical aviation/occupational medicine specialist, Dr David Lewis, was retained to report on the adequacy and efficiency of the RAAF's health monitoring system over the period of the DR programs[22].

13.29. Dr Lewis was provided with all material available to the BOI from searches of RAAF files and from investigating the RAAF regulatory framework from time to time regarding, first, the prescribed requirements for health monitoring, and second, evidence of health monitoring actually conducted. As noted above, the search of RAAF staff files, including medical staff files, provided limited evidence only of health monitoring conducted. Dr Lewis was also given access to the results of Dr Donaldson's investigation as it affected health monitoring.

13.30. Dr Lewis addressed the role of health monitoring of individuals, or “biological monitoring”, in a health and safety system. He summarised the benefits of biological monitoring (BM):

a. BM and biological effect monitoring (BEM) play an essential role in prevention of toxic material uptake;

b. BM can provide an early and individual detection;

c. BM accounts for the total daily exposure from occupational and non-occupational sources;

d. BM provides a more accurate measurement of total body burden especially in cases of chemicals having a long biological half life for their metabolism or excretion;

e. BM allows assessment of risk to an *individual* and has advantages where there are alternative or additional intake routes - all modes of entry are measured; and

f. BM & BEM complement environmental monitoring in the control of toxic substances in the workplace and can be used as a test of the efficiency and reliability of personal protection equipment.

13.31. It identifies the *susceptible worker,* a worker who is more susceptible to toxic risk due to genetic disorders, smoking, excessive consumption of alcohol etc.

13.32. Blood is the body fluid with the highest correlation to the substance absorbed, however due to the occasional need for frequent samplings, urine or breath testing is now frequently and effectively substituted.

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20 WIT.0346.001, Witness Statement of LT Wykes at par 42; WIT.0404.001, Witness Statement of LM Nowlan; WIT.0108.001, Witness Statement of MD Franke at par 29; WIT.0112.001, Witness Statement of JM Frost at par 40; WIT.0035.001, Witness Statement of DA Balassa par 33; WIT.0142.001, Witness Statement of RJ Hubbard at par 36; WIT.0292.001, Witness Statement of OR Zugno at par 42; WIT.0115.001, Witness Statement of RGP Gatley at par 48; WIT.0383.001, Witness Statement of R Knight at par 50.

21 WIT.0273.001, Witness Statement of DA Saunders at par 28; WIT.0380.001, Witness Statement of BJ Frohloff at par 10; WIT.0382.001, Witness Statement of HA Joiner at par 12

22 EXP.0004.001, Report of Dr Lewis dated 17 Mar 01

13.33. Concerning strengths and weaknesses of the RAAF's health monitoring system over the period of the DR programs, Dr Lewis concluded:

> **Program Strengths**: The policy and procedures for work practices; management responsibility (duty of care); environmental monitoring and biological monitoring requirements were all reported to be of a high standard and provided evidence of regular review and improvement. This opinion was stated to relate to command dictates only.
>
> **Program Weaknesses**: These comments were stated to have been made after reviewing the documentation provided and noted that the documentation may not be complete, or parts may have been lost or mislaid. The main weaknesses apparent from the available data were reported to be:
>
> (1). The difficulty of proving due diligence from the information provided.
>
> (2). The paucity of duty of care workplace documentation and record keeping.
>
> (3). Lack of evidence for competency training for Supervisors and Managers.
>
> (4). Poor evidence that the policy and procedures are actioned at the workplace level.
>
> (5). Apparent mismatch between the standards and requirements set by heads of departments and the resultant activities at the workplace.
>
> (6). Lack of medical record continuity for: personnel on the program, particularly short term involvement; medical examination call-up procedures; workplace standards for medical and biomedical testing and due diligence record keeping; training for medical personnel; centralisation and coordination of medical records; poor assessments of cognitive functioning.
>
> (7). Little evidence of regular, multi-departmental reviews of the overall program.
>
> (8). There is very little discussion on the appropriateness or specificity of the biomedical tests conducted.
>
> (9). There is a lack of continuity, multi-disciplinary unity and audit by the command and control structure. Such a structure found within the ADF should enhance this ability.

13.34. However, Dr Lewis also stated that the policy and procedures for, and range of, Biomedical Testing were appropriate for the standards and practices of the time, particularly when OH&S regulation was only first formalised in the early to mid 80’s.

13.35. Dr Lewis was provided with a copy of the most recent instruction for FTRS tradespeople and concluded that it met all the Australian regulatory requirements and in the main exceeded best practice standards internationally.

WGCDR Ross' Report

13.36. WGCDR Ross made a number of statements/conclusions generally addressing the issue of health monitoring at the time of his investigation in early 2000. His report included:

'There is no occupational health program on the base. The workers in FTRS were required to have an annual Occupational Health Assessment, but this was haphazard and uncoordinated. No one has specific responsibility for an occupational medicine program. As such, individuals were seen by several different Medical Officers, and there was thus little chance of identifying a possible problem earlier than it actually was. This is not to be particularly critical of Amberley: there is no requirement for such a program anywhere in the ADF. Nor is there a requirement that any MO at a base have some Occupational Health training or qualifications. Indeed there is no reliable source of Occupational Medicine advice within the ADF.[23]'

MEDICAL RECORDS

13.37. Overview. A number of specialist witnesses commented on the adequacy of RAAF personnel and medical records highlighting the current practices made the identification of trends within work groups difficult. Indeed it was difficult to identify over time when persons were within particular workgroups.

13.38. Report of CAPT Leslie Meredith. CAPT Meredith, a registered nurse and midwife was part of the Counsel Assisting Team's Medical Program working for Dr Donaldson. In her position she was required to examine members medical files to provide input to Dr Donaldson's report on the nature and extent of health complaints. Regarding the quality of personnel records and members medical records she reported:

a. **Deficiencies in Medical Records**: 'During the research of these (medical) documents several documents were found to be missing records, and other documents had documentation from other defence force members included in their medical documents…(Other problems) documentation was on the central medical file at Queanbeyan, but not on the serving members documents held at the Medical Centre of the bases they are currently serving (and vice versa).[24]'

b. **Personnel Records.** 'To determine dates of members on Deseal/Reseal there were additional documents used. These were AFPEMS, AERs, ATPCs, RETAs…Although we gained access to this additional information it was not easy to determine exact dates on members commencing and finishing Deseal/Reseal. The AFPEMS do not indicate into and out of the DR programs. They indicate posted to and out of particular units.[25]'

c. **Health Monitoring.** 'There did not appear to be a specific format in the medical documents for the testing of members that were working on the Deseal/Reseal programs. The pathology would sometimes have written on the forms Deseal/Reseal or alternatively Health Assessment. There did not appear to be a follow-up, or if there had been the file did not indicate this or the pathology did not appear on the file.[26]'

d. **Recommendations.** Her recommendations included: correct and accurate record keeping; a well-organised form of filing documents; development of a database; and reintroduction of specialist medical clerks.[27]

Witness Statements and transcripts

13.39. A number of witnesses, other than specialists retained by the CA Team, provided evidence to the BOI through witness statements and/or testimony before the BOI on medical

23 EXP.0001.001, WGCDR Ross Report at page 47.
24 EXP.0013.001, CAPT Lesley Meredith RAANC, Nature and Extent of Health Complaints at page 3.
25 EXP.0013.001, CAPT Lesley Meredith RAANC, Nature and Extent of Health Complaints at page 3
26 EXP.0013.001, CAPT Lesley Meredith RAANC, Nature and Extent of Health Complaints at page 4.
27 EXP.0013.001, CAPT Lesley Meredith RAANC, Nature and Extent of Health Complaints at page 5.

issues. The issues they raised are legitimate and Board discussion of the issues is given in volume 1, chapter 2. The issues included:

a. limitations on the RAAF medical services in detecting health trends within work groups;

b. the existence of a policy vacuum regarding health monitoring;

c. difficulties resulting from the current system of medical record keeping; and

d. the loss of relevant expertise and resources following ADF reorganisations, particularly in the mid-1990s.

13.40. Director Joint Health Support Agency provided a statement and testimony before the BOI. His evidence provided comment on a range of current medical issues, some of which is worth highlighting here.

a. **Health Monitoring Policy**. 'The RAAF policy requires the individual SMOs to evaluate work areas and practices to identify Occupational Health and Safety issues. The individual SMO must determine the need for assessment based on local knowledge of workplace hazards, and this responsibility is delegated to the SMO through DI(AF)PERS 53-4. DI (AF) PERS 53-4 is a policy document that relates to "Occupational Health Assessments"...I am aware that the RAAF has no specific requirement, apart from 5 yearly periodic medical examination (DI(AF)PERS 53-5), to ensure medical assessments of personnel unless the SMO feels a particular need that a medical assessment be undertaken…it is my opinion that the Senior Medical Officers in the RAAF may be more reactive than proactive.[28]'

b. **DSMA and ADF Reorganisations**. 'Historically, occupational health and medicine was managed by the single Service health directorates. These were amalgamated in the mid 1990's into the Directorate of Occupational Health and Safety under the Surgeon General Australian Defence Force. With the creation of the Defence Safety Management Agency (DSMA) and the move of the Directorate of Occupational Health & Safety outside Defence Health, Defence's management of matters relating to occupational health and medicine has been seriously compromised. The Directorate of Occupational Health and Safety's original, more comprehensive, focus has not been maintained with DSMA focussing upon safety at the expense of occupational medicine and health.[29]'

c. **Lack of Occupational Health Management.** 'What has actually happened in recent years is that occupational safety is managed by DSMA. There is no adequate Occupational Health or occupational medicine input. It is more attuned to the safety aspect of occupational control rather than of health. Safety has never been the role of the health practitioners like Occupational Health or medicine is. What this means is that, with the disbanding of the SGADF Directorate of Occupational Health and Safety, DSMA took all the personnel, financial and other resources but did not really take on the occupational health/medicine role. Defence Health Service Branch, without resources or official support, has tried to fill the gap by covering some of the issues under environmental health policy or preventative health policy. This approach has been supported by the Defence Reform Program, which saw occupational health sitting in Defence Health, but not necessarily by the Services…To the best of my knowledge, no one is specifically tasked to perform occupational clinical health surveillance within the workplace.[30]'

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[28] EXP.0010.001 (at 004, 006, 008), Statement of Andrew Geoffrey Robertson at pars 11, 16 and 20.

[29] EXP.0010.001 (at 006), Statement of Andrew Geoffrey Robertson at par 17.

[30] EXP.0010.001 (at 007), Statement of Andrew Geoffrey Robertson at par 20.

d. **SMOs and Environmental Health.** 'There is a cross reference in the DI (AF)PERS 56-1 to DI (AF)PERS 51-4 which delegates the SMO to be the adviser to the Commanding Officer or Officer Commanding in respect of all the health matters. It specifically states that Environmental Health personnel are directly responsible to the SMO for the provision of Environmental Health Services at Base and Unit levels. This supports the conclusion that I have set out above, and reinforces the supposition that the SMO is largely as effective as his Environmental Health Support team.[31]'

e. **Updating of Policy Documents.** 'A lot of the above policy, however, is outdated. Regular updating of the Instructions (DIs) and the amalgamation of single Service policy into joint policy is required and I consider this to be crucial in ensuring that the individual SMOs and Environmental Health Officers, or personnel, are aware of their occupational health monitoring and management requirements.[32]'

f. **Decentralisation/Centralisation of Policy**. 'In my opinion, policy and management of health surveillance should be centralised. Policy and surveillance should be the same for the three Services. For example, the policy for handling aviation fuel (AVTUR) and the monitoring, should be the same across Services. There must be a consistent health and OH&S monitoring policy between all Services. The implementations of monitoring does to some extent have to be decentralised given that there are peculiarities with respect to each individual Base. Processes are now in place whereby JHSA monitors the performance of various readiness indicators, including medical, dental and immunisation status, undertaken at each Base…This should include, but currently does not, occupational health surveillance as responsibility for this sits outside the Defence Health Service.[33]'

State of Medical and Scientific Knowledge Concerning Hazards, Health Risks and Best Practice

13.41. During the time of the first deseal/reseal program at Amberley, occupational health and safety, in the broader context, was inadequately resourced and understood in both areas of occupational hygiene and medicine. Standards were limited and lacked enforcement. Of relevance, in his 1980-81 Annual Report, the Commonwealth Director General of Health stated:

> 'Occupational health and safety is still a comparatively neglected area of endeavour in Australia with uncoordinated policies, programs and priorities and little formal training for professionals in the field.'

13.42. However, guides on industrial organic solvents (1980) isocyanates (1978) and Occupational Diseases of the Skin Prevention and Control of Occupational Hazards due to Atmospheric Contaminants (1980) were produced for information on the control of related health hazards. Hygiene standards and, later, threshold limit values for atmospheric contaminants, also becoming progressively available during this period.

13.43. House of Representatives Inquiry. In 1982, a report was written by the House of Representatives Standing Committee on Environment and Conservation, following an Inquiry into Hazardous Chemicals, which indicated the state of hazardous substance management generally in Australia. The Inquiry found that the regulation of chemicals in Australia was split between Commonwealth and State jurisdictions, and the responsibilities were split between labour and health authorities. It was found there was an insufficient number of inspectors

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31 EXP.0010.001 (at 010), Statement of Andrew Geoffrey Robertson at par 24.
32 EXP.0010.001 (at 011), Statement of Andrew Geoffrey Robertson at pars 25-26.
33 EXP.0010.001 (at 013 and 014), Statement of Andrew Geoffrey Robertson at par 28.

who were qualified to assess exposures to toxic chemicals. This resulted in problems with inspections, monitoring, and enforcement. Also, there was a lack of information disseminated to employers and employees on chemical hazards and their management[34]. According to the expert report commissioned for this BOI on the State of Medical and Scientific Knowledge[35]:

a. ‘The House of Representatives (1982) Report summarises the lack of information, product safety sheets and chemical management training among many other critical issues for the control of chemical hazards. Furthermore, protective measures for hazardous chemical exposures were widely deficient.

b. Again, the following excerpt from the 1982 Report indicates the ‘state of the art’ during the late 1970s and early 1980s:

‘While engineering controls are central to chemical hazard control in the workplace environment, the 1979-80 Annual Report of the Victorian Government’s Industrial Hygiene Section observed …’There is a surprising lack of dissemination of the principles of ventilation and of knowledge of the incorporation of contaminants in air streams. Ventilation engineering is little appreciated throughout the industrial community’…Other witnesses pointed to deficiencies of ventilation systems even of those specially designed for chemical hazard reduction.

The Committee also noted:

c. 'The necessity of engineering controls is further reinforced by the reluctance of some workers to use protective clothing or respirators provided. Evidence was given that where the effects of a chemical might not become evident for many years or where heat or exertion made their use uncomfortable, this ‘macho’ attitude was more of a problem.'

13.44. Exposure Standards. In 1983, the Commonwealth Department of Health produced an Approved Occupational Health Guide: Threshold Limit Values. The National Occupational Health and Safety Commission (NOHSC) was formed in 1985 and in 1988 produced Draft Exposure Standards for Atmospheric Contaminants in the Occupational Environment. These were eventually published as standards in 1990[36]. According to the expert report commissioned by the Counsel Assisting Team[37], exposure standards for key chemicals used in the Wings Program were available at the time of the program.

13.45. DI (AF) SUP 17-4. This instruction, dated 9 Jul 82, outlines the administrative procedures associated with the identification and codification of hazardous and potentially hazardous substances. Provisions for DI(AF)SUP 5-7 require that requests for the purchase of certain hazardous or potentially hazardous substances be referred to the Senior Medical Officer (SMO), Hygiene Officer (HYGO), or the Hygiene Inspector (HYGINSP), for approval before the purchase is authorised. DEFAIR (AFMED2C) is to register all requests received, and conduct a toxicological investigation to determine the medical aspects of handling, storage, use, fire, and explosive risk associated with the substance[38].

13.46. It is evident that the Commonwealth had published some specific and key health guides and codes of practice from the start of the first DR program, but that those standards

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[34] EXP.0011.001, Connell D. and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals – F-111 Fuel Tanks; Nov 00 at page 53.

[35] EXP.0011.001, Connell D. and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals – F-111 Fuel Tanks; Nov 00 at page 96.

[36] EXP.0011.001, Connell D. and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals – F-111 Fuel Tanks, Nov 00, Table 6 at page 53.

[37] EXP.0011.001, Connell D. and Miller G, State of Medical and Scientific Knowledge Deseal/Reseal Chemicals – F-111 Fuel Tanks, Nov 00, Table 6 at pages 58-59

[38] DI(AF)SUP 17-4; 9 Jul 82 at par 1, 4, 9.

and guides were incomplete. In time, standards became more comprehensive, particularly towards the end of the 1980s.

ANNEXES

Annex A – Dr Donaldson Report – Nature and Extent of Health Complaints

Annex B – List of Health Complaints

Annex C – Claims for Compensation

Annex D – Terms of Reference for the DVA/Defence Epidemiological Study

NATURE AND EXTENT OF HEALTH COMPLAINTS

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NATURE AND EXTENT OF HEALTH COMPLAINTS

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REPORT OF THE FINDINGS OF A REVIEW OF RAAF MEMBERS' MEDICAL DOCUMENTS DURING THE PERIOD OF THEIR INVOLVEMENT WITH THE DESEAL/RESEAL PROGRAMME

EXECUTIVE SUMMARY

1. This Report is based on an examination of the medical documents of 110 of the 662 members identified from the Board's records as being possibly exposed to chemicals. The remaining medical documents will be progressively examined and the contents of this report subsequently reviewed. As far as can be determined there is no bias in the selection of these personnel.

2. The reason for the number of medical files forming the basis for this report relate to the difficulty in identifying RAAF documents which would enable accurate and complete records to be compiled of all those who served on the Deseal/Reseal programmes and the time of their possible exposure.

3. Consequently, at the time of this Report, 110 RAAF personnel had been identified from documentary sources as having been involved in at least one of the Reseal/Deseal programmes. Their medical documents and results of their structured interview questionnaires were examined.

4. From the medical documents there were 15 presentations where chemical exposure was mentioned. These were instances of eye splashes, contact dermatitis and faintness and breathing difficulties after fume inhalation. Without the benefit of patient contact a number of undiagnosed conditions could be attributed to a chemical cause.

5. There appeared to be no consistent pattern of biological monitoring for chemical exposure during the majority of the Deseal/Reseal programmes. However, all abnormal Liver Function Tests and abnormal Full Blood Examinations were reviewed by a hepatologist, Professor Graham Cooksley. He found most of the abnormalities to be minor and transient but could not exclude the possibility of toxic liver damage in some cases on the evidence available.

6. The health questionnaires initially asked individuals for their recall of instances of exposure to chemicals when on the Deseal/Reseal programmes, any symptoms experienced at that time which they believed were due to chemical exposure and their presentations at the Base Medical Flight.

7. Almost all recalled exposure by skin contact and eye splash and listed symptoms, principally skin rashes, headaches, mood disorders and dizzyness. Thirty-five claimed to have sought medical advice.

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8. Information was sought on their current state of health and any current symptoms which they believed to be related to their work on the Deseal/Reseal programmes. Although most considered themselves to be in good health, 66% described symptoms they believed to be related to their work on the Deseal/Reseal programmes. A multiplicity of symptoms were described but skin symptoms, mood /neurological disorders and headaches predominated.

9. The discrepancy between the patients' recall of Base Medical Flight Consultations and the Medical Document evidence may be explained by failure to record the visit or symptoms in the Medical Documents, presentation outside the period of Medical Document review or faulty recall after many years. The medical documents were not always complete for the period under review but an error rate due to this in the report would be estimated to be less than 5%.

10. Some of the conditions ascribed to chemical exposure would not currently be recognized as having a chemical aetiology (cause), but many of the symptoms are consistent with those expected following absorption of toxic chemicals.

11. This is a descriptive report on the nature and extent of health complaints possibly arising from the Deseal/Reseal procedures. Any comment on the short or long term toxic effects of possible exposure to chemicals used on the Deseal/Reseal Programmes could only be made after a rigorous case controlled study. The evidence from the questionnaires would warrant such a study.

AIM

12. The aim of this Report is to identify, investigate and report on the nature and extent of health complaints and treatment provided, concerning complaints possibly arising from the Deseal/Reseal procedures and affecting ADF personnel connected with the Deseal/Reseal procedures, including any health monitoring of such complaints and any preventative action taken as a result of health monitoring.

13. The Report relates to the F111 Deseal/Reseal Board of Inquiry Term of Reference 3.b.(2), although it is highlighted that the Report does not address persons other than ADF persons.

METHODOLOGY

14. The medical documents of 110 of the 662 members with possible exposure were examined. The symptoms of which members complained were classified into gross aetiological divisions. The results of pathology tests used for health

screening were examined. A structured health interview/questionnaire **(Appendix 1)** was completed by all those possibly exposed. Comments relating to health from the witness statements were also reviewed.

IDENTIFYING THE DATA BASE

15. Unfortunately, no documents could be identified which enabled accurate and complete records to be compiled of all those who served on the Deseal/Reseal programmes, their actual tasks or the time of their possible exposure. Lists were compiled from unit photographs and the memories of individuals who had served on the programmes. The names of the members were necessary before their medical documents could be accessed. The 30 year-old memories were understandably far from exact and confirmation of the dates of serving was sought from the members' personal files, posting data, confined area allowances and annual reports etc **(Appendix 2)**. An interview was attempted with all the members identified and witness statements were also used to identify the period of service. Where definite documentation clearly delineated the period of service on the Deseal/Reseal programme the members were classified A. Where there was strong correlation between the member's statement and the documentary evidence, but there was some inconsistency, the members were classified B. Where there was no clear documentary support for the member's statement the member was classified C.

SELECTION OF PERIOD FOR EXAMINATION

16. The opinion from the toxicologist **(Appendix 3)** identifies the most likely period for immediate symptoms of toxicity to be manifest as the period of maximum exposure ie when the member was actually involved on the programme. The symptoms and signs relate to acute and chronic exposure by definition. The long-term effects of exposure were examined by structured interview/questionnaire. The documents of the members in Group A were reviewed for this report as the period of exposure could be accurately identified at the time of writing. As the selection process appears to be without bias and is approximately one-sixth of the total population exposed, there is no reason to suspect that this Group is not representative of the total Group. It is the intention to add to the sample as further research identifies more members of Group A. It is unlikely that these additions will alter the general findings.

DATA COLLECTION

17. All of the documents were perused by four investigators familiar with medical terminology and Defence Force Health Services. The RAAF personnel were classified into three groups by reference to a number of documents **(Appendix 2)**. All entries in the medical files during the period indentified as the exposure period

were reviewed and classified according to aetiology by an occupational health physician. Any medical officer comment relevant to chemical toxicity was noted. The details of all pathology tests during the period were also recorded and the abnormal results were reviewed by a Hepatologist, Professor G Cooksley **(Appendix 4)**. The questionnaire responses were classified by an Occupational Health Physician.

RESULTS

18. The results are summarised below and the raw data is attached **(Appendix 5)**:

NUMBER OF DOCUMENTS

19. One hundred and ten documents were examined from the 662 who claimed exposure.

GENDER

20. The personnel were predominantly male >99%.

AGE

21. The average age of first contact with the programme was 23 years (range 17 to 46). The average age in 2000 was 39 years (range 29 to 65).

NUMBERS OF PEOPLE INVOLVED

22. The numbers of people involved in each programme in the sample of 110 and the number of person/months are set out below.

	Number of people	Person/months
Programme 1	56	1374
Wing Programme	85	3024
Spray Programme	35	1202

23. The average number of medical presentations per month:

Programme 1	0.28
Wing Programme	0.45
Spray Programme	0.43

24. The rate of presentation per month within the broad group of aetiologies which accounts for all cases:

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	Infection	Trauma	allergy	Neoplasia	psychiatric/ neurological	chemical	other
Programme 1	0.11	0.07	0.01	0.00	0.00	0.03	0.05
Wing Programme	0.18	0.15	0.02	0.00	0.01	0.02	0.07
Spray Programme	0.16	0.14	0.01	0.00	0.01	0.02	0.1

25. Fifty-three personnel presented with symptoms which may have been related to chemical exposure. In only 15 cases was a diagnosis of chemical exposure made by the Medical Officer. Seven instances of eye splash, 5 diagnoses of contact dermatitis and 3 of fume inhalation.

26. Examination of the pathology reports during the period of possible exposure showed 52 cases of abnormalities in the liver function tests although some of the abnormalities had an infective origin and some of the abnormalities were minor. Eleven of the persons had abnormal blood film reports but most could be attributed to infection or allergy. In 9% of the cases examined there were no pathology reports available for the reference periods.

27. From the structured Interviews and 105 Health Questionnaires (5 not useable) answered in late 2000, 105 persons claimed skin exposure to chemicals. The average exposure in this group approached monthly. 104 persons claimed eye splash exposure with some claims of monthly exposure.

28. From the structured interview/questionnaire 71% claimed to have had symptoms at the time of exposure and 66% claimed current symptoms which they attributed to their chemical exposure.

29. The following symptoms were identified by the person involved as being relevant to their exposure to chemicals on the Deseal/Reseal programme:

	At the time of their exposure	Since leaving the programme
Sinus symptoms		9
Eye symptoms	16	6
Chest symptoms	9	11
Skin symptoms	54	42
Gastro-intestinal symptoms	13	10
Headaches	42	19
Memory loss	9	14
Dizzyness	19	3
Mood and neurological disorders	31	28
Skin odour	10	0

30. Thirty-five persons claimed to have consulted a Health Professional about their symptoms at the time of exposure and forty-two had reported their current symptoms to a health professional. Forty received treatment for their complaints.

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From the witness statements 69 persons claim to have symptoms related to their involvement with the programmes at the time of their Service.

31. The average state of health of the Group is good with 23 describing their health as excellent and only 3 were debilitated and in very poor health. Two persons consulted a health professional every week and 25 consulted a health professional less than once per year. Thirty-three people were receiving treatment for a complaint, not necessarily related to their exposure symptoms. Eighty-eight percent played sport or exercised. Eighty-nine percent were in some form of employment. Eighty-one percent had children, 6 of the children had birth defects, 6 were described as not healthy, 13 had developmental problems and 16 suffered from allergies.

EXPLANATORY NOTES ON THE RESULTS

32. In many cases the Medical Officer's opinion of the aetiology of the symptoms and signs was not stated and the classification became a matter of judgement of the reviewing Occupational Health Physician on the entry in the Medical Record. Without the patient and the ability to elicit further information, the decision was made to classify all conditions not clearly diagnosed, which could possibly have a chemical aetiology, as having a chemical causation. This has undoubtedly skewed the results for there is no reason to doubt the competency of the Medical Officers who have made any of the entries in the Documents received. Where the Medical Officer has suspected a chemical cause for the complaint, he has noted his opinion and treated the patient appropriately. However, the view was taken that if the Documents were perused with the specific intention of finding evidence to support a claim that the patient's current symptoms stem from an initial episode while on the Deseal/Reseal programme, entries with ill-defined or no diagnosis could be considered evidence to support the claim.

33. Many of the symptoms thus classified would be very common in the Amberley personnel with no exposure to the Deseal/Reseal programme. Skin rashes, breathing difficulties, irritated eyes and abdominal cramps would be assessed by the Medical Officer by using the history and his clinical experience. In some cases where there has been doubt, the Medical Officer has taken the history and recorded it in some depth to eliminate chemical exposure as the causative agent.

34. Diarrhoea and vomiting are common presentations and as with upper respiratory tract infections the actual aetiological agent is rarely identified. These conditions are so common in the community that where they run their expected course they were not included as possible symptoms of chemical exposure.

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35. For consistency, all presentations at the medical flight were included. A more severe illness or injury or post-operative management could result in many presentations for the same condition.

36. The categories used in appendix 5 are self explanatory with the exception of ‘Other’. This category includes: minor operations, pigmented skin-lesion assessments, counselling, solar keratoses, etc.

37. In reporting the symptoms from the questionnaire, tabulation is only practical for the more frequent symptoms. Symptoms not included in the tabulation are listed in Appendix 6.

COMMENT AND CONCLUSIONS

38. The symptom of unusual body odour and the evidence of eye splash and contact dermatitis, point to a degree of exposure and absorption of toxic chemicals. It is not possible from the medical records to define the toxic agents except in the cases of eye splash. In this case the agents were not specific to the Deseal/Reseal process. Methyl ethyl ketone is widely used and is the chemical most frequently splashed into the eye in this sample.

39. The average number of attendances to the Base Medical Flight per individual per month requires a comparison with the figures of personnel not exposed to the toxic environment for it to be accorded a level of significance. Other factors well known to affect the attendance rate of Defence Force Personnel are morale of the Unit and the prevailing Unit culture at the time. These are not constants and can easily skew the findings. There is a wide range of symptoms experienced at the time of exposure in the anecdotal evidence from the Witness Statements and Questionnaires. Seventy-seven percent claim to have had symptoms related to their employment. These are principally skin problems, headache, dizziness and a range of symptoms which can be broadly classified psychiatric and neurological. One-third (35 persons) claim to have reported their symptoms to a health professional.

40. From the medical documents there are 15 instances where chemical exposure is mentioned in the diagnosis. Without the vital evidence from history and examination of the patient that was available to the medical officer, another 105 presentations of symptoms with ill-defined or no diagnosis could be included, but this number would include several presentations for the one condition. The nature and extent of these health complaints were principally skin rashes, eye inflammation and irritation, dyspnoea and syncope. The conditions were managed appropriately according to accepted medical practice in Australia and as far as can be ascertained from the medical documents, the conditions responded well to the management.

NATURE AND EXTENT OF HEALTH COMPLAINTS

41. The discrepancy between figures from the medical documents and the figures from the Health Questionnaire may be due to faulty recall or failure to record or to presentations outside the strict time periods of this investigation.

42. At the time of the questionnaire 66% claimed to have symptoms which they attributed to their work on the Deseal/Reseal programme. These symptoms include headaches, loss of memory, skin problems and psychiatric or neurological disorders. There was one instance of Disseminated sclerosis; three of Arthritis; one of breast Cancer; one of Diabetes; one of Nephritis and one of Ankylosing spondylitis. Many of the symptoms in this age group could have alternate aetiologies.

43. The sample's assessment of their state of health is good and this is reflected in their frequency of health consultations and exercise and employment history.

44. The number that have children, the incidence of birth defects, developmental abnormalities and allergies appears to be within the expected population range but this would need more information from a control study for confirmation. The health monitoring did highlight a number of pathology test abnormalities. However in eleven instances there was no evidence of any biological health monitoring for chemical exposure. As some of the abnormalities were not found in subsequent tests after the patient was removed from the Deseal/Reseal environment in response to the abnormal test there may be some evidence of a causal link. However, the magnitude and frequency of the abnormal results in the opinion of Professor Cooksley could reflect physiological variation and intercurrent disease in the community. It is also possible that some abnormalities may be evidence of toxin induced damage. The abnormalities did not appear to be associated with symptoms.

45. As far as the medical documents allow, it appears that most but not all abnormal tests were followed up. The medical documents alone do not provide evidence of any general workplace changes.

46. No comment can be made on the significance of exposure to the toxic chemicals in the Deseal/Reseal programme in terms of presenting symptoms or long term effects without a case controlled study or an epidemiology study as proposed by DVA.

Dr Eric Donaldson
21 March 2001

APPENDICES

APPENDIX 1 - Structured Interview/Questionnaire

APPENDIX 2 - Information used to establish involvement in the Deseal/Reseal programme

APPENDIX 3 - Statement on relationship between short-term exposures to deseal/reseal chemicals and possible health effects

APPENDIX 4 - Report Professor Cooksley

APPENDIX 5 - Compilation of data

APPENDIX 6 - Additional symptoms from the structured Interview/Questionnaire

APPENDIX 1 -

Structured Interview/Questionnaire

HEALTH QUESTIONNAIRE

2000/2001

001 Name:

002 Date of Birth:

003 Service Number:

004 Rank:

005 Sex:

On the following pages please answer every question to the best of your recollection.

The answers given will be treated strictly in confidence and will not be given out to any other party.

During what period were you exposed to chemicals?

006 Date:______________________________

007 Number of months:______________________

CHEMICAL/ SUBSTANCE SKIN EXPOSURE

We are interested in finding out which chemicals or substances **came into contact with your skin**, and **how often** did this occur. Below is a list of chemicals. Please circle the appropriate answer to indicate your **skin exposure**.

		1	2	3	4	5	6
008	SR51 solvent	Don't Know	Never	Rarely	Monthly	Weekly	Daily
009	MIL-C-38736 solvent cleaner (MEK)	Don't Know	Never	Rarely	Monthly	Weekly	Daily
010	PR148 Primer	Don't Know	Never	Rarely	Monthly	Weekly	Daily
011	SS4004 Primer	Don't Know	Never	Rarely	Monthly	Weekly	Daily
012	XA3598 epoxy barrier	Don't Know	Never	Rarely	Monthly	Weekly	Daily
013	MIL S-83430 sealant (PR 1750 A/B)	Don't Know	Never	Rarely	Monthly	Weekly	Daily
014	MMS425 epoxy primer	Don't Know	Never	Rarely	Monthly	Weekly	Daily
015	PR2911 sealant (black and white)	Don't Know	Never	Rarely	Monthly	Weekly	Daily
016	MIL-C-81706 class 1A foam IV	Don't Know	Never	Rarely	Monthly	Weekly	Daily
017	PR-1826 B2	Don't Know	Never	Rarely	Monthly	Weekly	Daily
018	EC 3580 epoxy barrier	Don't Know	Never	Rarely	Monthly	Weekly	Daily
019	Z1400 alkaline wash	Don't Know	Never	Rarely	Monthly	Weekly	Daily
020	Q4/ 2817 sealant	Don't Know	Never	Rarely	Monthly	Weekly	Daily
021	Other:__________________	Don't Know	Never	Rarely	Monthly	Weekly	Daily
022	Other:__________________	Don't Know	Never	Rarely	Monthly	Weekly	Daily
023	Other:__________________	Don't Know	Never	Rarely	Monthly	Weekly	Daily

CHEMICAL/ SUBSTANCE INHALATION EXPOSURE

We are interested in finding out which chemicals or substances **you inhaled** during the program, and **how often** did this occur. Below is a list of chemicals. Please circle the appropriate answer to **indicate whether you inhaled a strong smell of chemicals in the air.**

		1	2	3	4	5	6
030	SR51 solvent	Don't know	Never	Rarely	Monthly	Weekly	Daily
031	MIL-C-38736 solvent cleaner (MEK)	Don't know	Never	Rarely	Monthly	Weekly	Daily
032	PR148 Primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
033	SS4004 Primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
034	XA3598 epoxy barrier	Don't know	Never	Rarely	Monthly	Weekly	Daily
035	MIL S-83430 sealant (PR 1750 A/B)	Don't know	Never	Rarely	Monthly	Weekly	Daily
036	MMS425 epoxy primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
037	PR2911 sealant (black and white)	Don't know	Never	Rarely	Monthly	Weekly	Daily
038	MIL-C-81706 class 1A foam IV	Don't know	Never	Rarely	Monthly	Weekly	Daily
039	PR-1826 B2	Don't know	Never	Rarely	Monthly	Weekly	Daily
040	EC 3580 epoxy barrier	Don't know	Never	Rarely	Monthly	Weekly	Daily
041	Z1400 alkaline wash	Don't know	Never	Rarely	Monthly	Weekly	Daily
042	Q4/ 2817 sealant	Don't know	Never	Rarely	Monthly	Weekly	Daily
043	Other: ______			Rarely	Monthly	Weekly	Daily
044	Other: ______			Rarely	Monthly	Weekly	Daily
045	Other: ______			Rarely	Monthly	Weekly	Daily

CHEMICAL/ SUBSTANCE EYE SPLASH EXPOSURE

We are interested in finding out which chemicals or substances **may have splashed into your eyes** during the program, and **how often** this occurred. Below is a list of chemicals. Please circle the appropriate answer for each chemical to indicate whether the chemicals **splashed** into your **eye.**

		1	2	3	4	5	6
050	SR51 solvent	Don't know	Never	Rarely	Monthly	Weekly	Daily
051	MIL-C-38736 solvent cleaner (MEK)	Don't know	Never	Rarely	Monthly	Weekly	Daily
052	PR148 Primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
053	SS4004 Primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
054	XA3598 epoxy barrier	Don't know	Never	Rarely	Monthly	Weekly	Daily
055	MIL S-83430 sealant (PR 1750 A/B)	Don't know	Never	Rarely	Monthly	Weekly	Daily
056	MMS425 epoxy primer	Don't know	Never	Rarely	Monthly	Weekly	Daily
057	PR2911 sealant (black and white)	Don't know	Never	Rarely	Monthly	Weekly	Daily
058	MIL-C-81706 class 1A foam IV	Don't know	Never	Rarely	Monthly	Weekly	Daily
059	PR-1826 B2	Don't know	Never	Rarely	Monthly	Weekly	Daily
060	EC 3580 epoxy barrier	Don't know	Never	Rarely	Monthly	Weekly	Daily
061	Z1400 alkaline wash	Don't know	Never	Rarely	Monthly	Weekly	Daily
062	Q4/ 2817 sealant	Don't know	Never	Rarely	Monthly	Weekly	Daily
063	Other: ____________			Rarely	Monthly	Weekly	Daily
064	Other: ____________			Rarely	Monthly	Weekly	Daily
065	Other: ____________			Rarely	Monthly	Weekly	Daily
066	Other: ____________			Rarely	Monthly	Weekly	Daily

SYMPTOMS AT THE TIME OF EXPOSURE

This section deals with finding out information on the **symptoms** you experienced **during your period of exposure to the chemicals**. Please identify any symptoms you suspect were related to your exposure.

Description of symptom: Category- (Official use only).

067 • ____________________

068 • ____________________

069 • ____________________

070 • ____________________

071 • ____________________

072 • ____________________

073 • ____________________

074 • ____________________

075 If you consulted a health professional for these symptoms, what was the diagnosis?

____

076 What was the treatment?

____

SYMPTOMS SINCE LEAVING THE PROGRAM

This section deals with finding out information on the **symptoms** you experienced **after you have left the program**. Please identify any symptoms you suspect were related to your exposure.

Description of symptom: Category- (Official use only).

080 • ______________________

081 • ______________________

082 • ______________________

083 • ______________________

084 • ______________________

085 • ______________________

086 • ______________________

087 • ______________________

088 • ______________________

089 If you consulted a health professional for these symptoms, what was the diagnosis?
____

090 What was the treatment?
____

091 What was the **name** of the health professional and the **place** of consultation?______________________

CURRENT STATE OF HEALTH

This section deals with finding out about your current state of health. Please circle the number that best fits your answer.

092 How would you describe your current state of health compared to others of your age who did not serve on the program?

1. Excellent - (no health problems)
2. Good - (activity not restricted by condition)
3. Fair (activity and enjoyment of life restricted by health)
4. Very poor- (debilitating illness)

093 How often do you consult a health care professional now?

1. Every week
2. Every month
3. Every three months
4. Every six months
5. Every year
6. Less than once a year

094 Are you having any therapy, treatment or medication? Please specify:______________________________

____

____

____

____

095 Who is your current health professional? Please state name and contact details.______________________________

____

____

____

096 Do you play sport or exercise?
1. Never 2. Occasionally 3. Regularly

097 Are you employed?
1. Yes full- time 2. Yes part- time 3. No

098 Do you have children? Yes No

099 If yes, are they healthy? Yes No

Do they have any of the following health problems?

100 Birth defects Yes No

101 Developmental problems Yes No

102 Allergies Yes No

103 Other (Please specify)

____

____

____

For official use only:

104 ☐

105 ☐

106 ☐

107 ☐

APPENDIX 2 -

Information used to establish involvement in the Deseal/Reseal programme

APPENDIX 2 - INFORMATION USED TO ESTABLISH INVOLVEMENT IN DESEAL/RESEAL PROGRAMME

	Dates for Programmes
Programme 1	October 77 to February 82
Wing Programme	August 85 to June 92
Spray Programme	March 96 to November 99

- Medical Documents - Tests/investigations based on involvement in Deseal/Reseal programme.
- Airmans Evaluation Report – AER.
- Reporting that member worked in Deseal/Reseal Programme, fuel tank repair/maintenance of F-111.
- Record of Employment and Task Authorizations – RETA.
- Stating work or courses involved in the F-111 fuel tank repair or maintenance or confined space courses.

Other Supporting Documents:

- Occupational hygiene report.
- PM 126 annotation stating involvement in Deseal/Reseal.
- Occupational health assessment - fuel tank entry.
- Posting amplification.
- Occupational health assessment requirements.
- Witness statements.
- Health questionnaire.

UNITS AT AMBERLEY THAT MAY HAVE SUPPLIED PERSONNEL FOR DESEAL/RESEAL PROGRAMMES

- **Current** - 1 SQN, 6 SQN, 501 WG, 382 ECSS, HQ 82
- **Previous Units** - 1 SQN, 6 SQN, 482 SQN, 3AD, 301 ABW, 301 BSW, BS AMB, ASS AMB, CSS AMB, CSW AMB, 82 WG, 114 MCRU, 2 SQN, 9 SQN, 12 SQN.

MUSTERING CATEGORIES MOST LIKELY TO BE INVOLVED IN DESEAL/RESEAL PROGRAMMES

AFITT, AMECH, ATECH, ADATECH, AFMCH, ARMFITT, ARMMECH, AVTECH, ENGFITT, ENGNECH, ELECFITT, ELECMECH, GSEFITT, GSETECH, INSFITT, INSTMECH, AMTFITT, MTMECH, RADTECH.

APPENDIX 3 -

Statement on relationship between short-term exposures to deseal/reseal chemicals and possible health effects

STATEMENT ON RELATIONSHIP BETWEEN SHORT-TERM EXPOSURES TO DESEAL/RESEAL CHEMICALS AND POSSIBLE HEALTH EFFECTS

PREPARED FOR F1-11 BOARD OF INQUIRY

MEDICAL PROGRAM

BY

PROFESSOR DES CONNELL

AND

DR GREG MILLER

2000500/ENVIROTEST

The term *toxicity* generally describes adverse health effects, which occur after contact with toxic substances. These effects may be acute or chronic, depending on dose, mode and duration of exposure and the chemical properties of the toxicant.

Toxic effects are by definition not beneficial but deleterious, and the type and severity of toxic effects that can occur is very broad, ranging from temporary sublethal effects to lethality.

These adverse effects may occur in many forms, ranging from immediate death to subtle changes not realised until months or years later. The effects may be expressed at various levels within an organism, such as an organ, a cell, or a specific biochemical process.

The Agency for Toxic Substance and Disease Registry (ATSDR, 1992) defines an acute exposure as an exposure to a chemical for a duration of 14 days or less. Although the duration of exposure may be brief, the chemical concentration may be high.

Generally, the higher the dose, the more severe the response. The dose-response relationship is based on observed data from experimental animal, human clinical or cell studies.

The U.S. National Library of Medicine defines an acute exposure as a single dose or a series of doses received within a 24-hr period. Subchronic toxicity results from repeated exposure for several weeks or months.

Chronic toxicity represents cumulative damage to specific organ systems and takes many months or years to become a recognisable clinical disease.

The toxic effects due to short-term exposure, usually relatively high doses, are more readily observed. Also, these effects are often well described in the scientific and medical literature. For example, exposure to solvents in the RS/DS Programs was estimated to be in high concentrations in the confined spaces of fuel tanks. This would represent acute exposures, generally, well above workplace exposure limits.

If inadequately protected, exposed personnel would be expected to develop short-term effects including headaches, nausea, dizziness, irritations of eyes and skin and acute respiratory distress. Severe acute effects should be experienced or observed during the period of chemical use.

Chronic or repeated exposures, which can vary greatly in the dose to which the body is exposed, also are very likely to have occurred during the Programs. The adverse effects of these exposures may differ from those observed with acute or short-term exposures. Some of the possible effects are of a physiological and behavioural nature, which could have become apparent during the DS/RS Programs.

On the other hand, some cumulative damage to organs such as skin sensitization, liver and kidney damage may only become apparent at extended periods after exposures have occurred. The diagnosis of any such effects would depend on clinical assessment.

Some of the DS/RS Chemicals have the capacity to cause delayed and long-term effects depending upon conditions. The investigation techniques required to evaluate these effects would come into the general category of health surveillance (e.g. clinical evaluation and biological monitoring) and epidemiology. The latter technique uses statistical evaluation to examine relationships between exposures and specific health effects within exposed and control populations.

These types of assessments are usually complicated by individual variation, relatively small numbers of exposed persons, long periods for some effects to develop and the incidence of related health effects in unexposed persons.

References:

ATSDR (1992) *Medical Management Guidelines for Acute Chemical Exposures.* US Department of Human Services, Agency for Toxic Substances and Disease Registry.

APPENDIX 4 -

Report Professor Cooksley

EXP.0003.029

REVIEW OF LABORATORY ABNORMALITIES IN DEFENCE STAFF WORKING ON TANK CLEANING PROGRAMS
WGE Cooksley

66 patient charts were reviewed consistingof
- Bilirubin abnormalities 11
- ALT abnormalities 19
- AST abnormalities 4
- Protein abnormalities 6
- WCC abnormalities 15
- Infections 3
- Alkaline phosphatase abnormalities 8

These tests were carried out over a long period of time using different methods and many different pathologists. Defining the reference range is to some extent arbitrary and this range may vary from time to time and laboratory to laboratory. Many cases of laboratory abnormalities are actually values I unit above the reference range which may simply be a variant of normal. The classic example of this is bilirubin.

BILIRUBIN

6 of the 11 can be regarded as normal or physiological with a low reference range.

5 cases could be regarded as Gilbert's syndrome asshown by a persistently elevated Bilirubin which on fractionation consists of unconjugated bilirubin. In some cases but not all fractionation was carried out and ocasionally haemolysis was excluded. Gilbert's is a harmless,inherited condition which constitutes about 5% of the community. In these patients the level was unrelated to chemical exposure. Only one patient had classical Gilbert's where tht bilirubin was>2x reference range. The others were mild.

ALT

The elevation was mild, usually intermittent elevation of ALT +/- GGT+/- Alk Phos. When information is available obesity is evident in 5 (suggesting Non Alcoholic steatohepatitis, 4 were borderline, 2 were in the presence of excess alcohol ingestion, leaving 8 unexplained. In 2 hyperbilirubinaemia was concurrent probably unconjugated. The fluctuations did not appear to correlate with chemical exposure.

AST

All 4 were normal or borderline. One was associated with mild hyperbilirubinaemia. No correlation with exposure.

PROTEIN ABNORMALITIES

All 6 had mild hyperalbuminaemia which is due to sampling after the blood tourniquet has been left on too long.

WHITE CELLS, ETC

Most were not unexpected being consistent with intermittent viral illness or bacterial infection. 4 had eosinophilia which would seem to be more common than one might expect in a healthy population.

ALKALINE PHOSPHATASE

7 had Alk Phos ranging rom borderline at 113 to mildly abnormal at 141 (ref range 112).In 6 the last alk phos was normal ie not sustained. In 3 of 7 it was abnormal on 2-3 occasions and in 2 of these was normal in between. In 2 patients there was an abnormal ALT or AST but not when the alk phos was elevared. The changes occurred during the program on 6 occasions and outside on 7. To summarise one would say the abnormalities were mild and transient.

INFECTIONS

In 3 cases abnormal LFT were found in association with infections viz Malaria, Ross river infection, and anti hepatitis surface and core antibody.It is possible the last result was the endof acute hepatitis B but the earlier course was not confirmed nor excluded.

EXP.0003.030

OVERALL OPINION

A substantial no of individuals had abnormalities. The majority were borderline or mild. In no case was was it marked.In few cases was specialist advice sought. They were what might be expected in a population of healthy young people over a period of time. Half of these had results that were borderline or could be attributed to a specific cause such as alcohol,fatty liver (NASH) or Gilbert's because there was clinical data available. Whether the others could also be attributed would be speculative.

However, one could ask if the changes in some patients could be due to a chemical toxin and the answer would be "possibly". These would most likely be elevations in ALT/AST although some could produce elevation in alk phos. Certainly we did not see a uniform pattern in those for whom we had no alternate explanation. I had the impression that there were more with an elevated alk phos than would expect. Similarly there appeared a considerable no with presumed Gilbert's Syndrome although bilirubin fractionation and haemolytic screen were only occasionally done. One could postulate a mechanism on bilirubin metabolism. One also notes that many patients had eosinophilia. Although there are other mechanisms such as parasites, allergic diathesis eg asthma, it is consistent with hypersensitivity to exogenous compounds including chemicals. The failure to correlate with the times of exposure may not be of significance. Firstly the dates may be inaccurate and secondly there may be a delay in toxicity and thirdly the response may be transient.

The results do seem to be mild and transient. That is probably why few were referred foran opinion or a liver biopsy was considered. With hindsight one would advocate a liver biopsy so that the nature of the disease could be established, the severity ascertained and the likelihood of progression estimated. Although one assumes that any effects were transient it is possible there are persistent abnormalities that would not be apparent on blood tests.

In conclusion, one could say it is entirely possible all these abnormalities reflected physiological variation and intercurrent disease in the community. On the other hand. It is possible only a proportion have such an explanation and there has been toxin induced damage. Although it is likely that any such damage is mild and transient that could not be stated confidently without biopsy. To clarify some issues the following could be carried out – (I) retrospective analysis of a comparable group's medical records to see whether the frequency and pattern is the same and (ii) a prospective study with a formal protocol of liver function in people carrying out this type of work.

19/3/01

CURRICULUM VITAE OF WILLIAM GRAHAM EARNSHAW COOKSLEY

EXP.0003.031

PROFESSOR W.G.E. COOKSLEY
DIRECTOR OF CLINICAL RESEARCH CENTRE
ROYAL BRISBANE HOSPITAL FOUNDATION

Address:	Clinical Research Centre Royal Brisbane Hospital Brisbane, 4029
Telephone:	(07) 3362 0171
Home Address:	13 Sefton Road Clayfield, Q'ld 4011
Telephone:	(07) 3262 3270

Personal Details:	Date of Birth - 30.5.1940	
	Wife	Enid Vivienne
	Son	Graham Andrew
	Daughter	Anna Katrina

SUMMARY

Present Position: Director and Professor, Clinical Research Centre, Royal Brisbane Hospital Foundation, 1988-
Consultant Physician, 1974-
Consultant Biochemist, 1975-
University of Queensland, Royal Brisbane Hospital

Previous Positions:	1964-65	Resident Medical Officer, Royal Brisbane Hospital
	1966	Registrar in Paediatrics, Royal Brisbane Hospital
	1967	Registrar in Pathology, Royal Brisbane Hospital
	1968	Registrar in Medicine, Royal Brisbane Hospital
	1969-70	Clinical Lecturer, University of Queensland
	1971-72	National Health and Medical Research Council, Medical Postgraduate Research Scholar, University of Queensland
	1973-74	Visiting Research Fellow (Nuffield), Clinical Research Centre, Harrow, England
	1974	Research Fellow, Department of Medicine, University of Queensland.
	1975-79	Senior Lecturer in Medical Biochemistry, University of Queensland
	1981	Visiting Scientist, Liver Disease Unit, National Institutes of Health, U.S.A.
	1985	Guest Worker, Liver Disease Section, National Institutes of Health, U.S.A.
	1979-88	Associate Professor in Medical Biochemistry, University of Queensland
Qualifications:	1963	M.B.,B.S. University of Queensland
	1969	M.R.A.C.P.
	1974	F.R.A.C.P.
	1978	M.D. University of Queensland
Awards:	1958-63	University Open Scholarship, University of Q'ld.
	1962	Queensland Freemasons Scholarship
	1971-72	N.H.M.R.C. Medical Postgraduate Research Scholarship
	1973-74	Nuffield Travelling Fellowship in Medical Sciences for Australia.

Office Bearer of Associations for the Study of the Liver:

Asian Pacific Association for Study of the Liver
1982-86 Honorary Secretary
Gastroenterology Society of Australia
1975-84 Councillor 1975-79 Honorary Treasurer
Gastroenterology Society of Queensland
1982-85 Member of Executive 1983-85 Honorary Treasurer

Membership: Asian Pacific Association, Study of Liver, European Association for Study of the Liver; American Association for Study of Liver Diseases; International Association for Study of the Liver.

Office Bearer of the Australian Society for Medical Research:

1975-78 Director 1976 Editor
1977 Treasurer

Consultant Positions:

National

- Consultant to Australian Government (International Development Program)
- Consultant to Queensland Government - Hepatitis B Vaccination; Hepatic Transplantation; Centres for Treatment of Hepatitis C; Management for Health Care Workers with Infectious Disease..
- Consultant to Viral Hepatitis Prevention Board.

International

- Consultant to Pan Pacific Working Party on Control of Hepatitis B.
- Chairman of Steering Committee for Prevention and Control of Infectious Diseases in Asia.
- Member of International Advisory Committees (Interferons, antiviral agents, therapeutic vaccines)

Editorial Boards:

- Journal of Gastroenterology and Hepatology 1984 -
- Journal of Viral Hepatitis 1993 -
- Journal of Gastroenterology and Hepatology (Italy) International Editorial Board 1997-

Organisation of International Meetings:

- Committee of Scientific Meeting for International Association for the Study of the Liver, Surfers Paradise, 1990
- Committee of Scientific Meeting for International Society for Biomedical Research in Alcoholism, Surfers Paradise, 1994
- Organiser, 3rd International Meeting on Hepatitis Cand Related Viruses (Molecular Virology and Pathogenesis) and 5th International Meeting on Hepatitis D, Surfers Paradise, 1995.
- Convenor for Clinical Stream, First Australasian Conference on Hepatitis C, Sydney, March, 1997.
- Organiser, 7th International Meeting on Hepatitis C Virus and Related Viruses (Molecular Virology and Pathogenesis) 3-7 December, 2000.

Publications and Presentations:

More than 160 publications in the scientific literature; nearly 100 invited lectures at national or international meetings; over 100 presentations at international scientific meetings; and nearly 200 presentations at national scientific meetings.

19/7/01

APPENDIX 5 -

Compilation of data

MEDICAL

	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
2	1	M	✓	88-00	88 - present	W	15/4/88 - 7/92 (51)	0.37
3	2	M	✓	85-86	1/85-8/86	1	10/77-2/82 (53)	0.19
4		"		"	"	W	8/85-26/8/86 (13)	0.00
5	3	M	✓	78-82,85,89-92,91-93.	75-86, 90-93	1	10/78-2/82 (41)	0.49
6		"		"	"	W	1/85-12/85, 1/89-6/92 (42)	0.67
7	4	M	✓	77 - 93	10/77-9/78, 8/89-1/91	1	10/77-5/5/80 (31)	0.39
8		"		"	"	W	30/9/85 - 6/92 (69)	0.57
9	5	M	✓	81-84, 91-92	83-86	1	26/8/81-2/82, (6)	0.50
10		"		"	"	W	8/85-19/8/87, 24/11/87-18/9/90 (59)	0.97
11	6	M	✓	81-82,89-92,91-93,96-99	89-93, 98-00	1	3/4/81-2/82 (11)	0.00
12		"		"	"	W	4/7/89-6/92 (36)	0.11
13		"		"	"	S	3/96-11/99 (45)	0.18
14	7	M	✓	79-82, 85-86	3/79-12/80	1	16/2/79 - 2/82 (36)	0.44
15		"		"	"	W	8/85 - 5/86 (9)	0.00
16	8	M	✓	91-92,91-93,96-97	91-97	W	16/1/91 - 6/92 (18)	0.72
17		"		"	"	S	3/96 - 16/6/97 (16)	0.38
18	9	M	✓	85-87	8/83 - 2/85	W	8/85 - 13/4/87 (20)	0.10
19	10	M	✓	85-92, 91-93	No dates given	W	8/85-6/92 (71)	0.94
20	11	M	✓	3/96-11/99	97-99, 6/93-6/99	S	3/96 - 11/99 (33)	0.88
21	12	M	✓	78	1/77 - 8/77	1	20/12/78 - 2/82 (37)	0.30
22	13	M	✓	87 - 91	11/87 - 1/91	W	8/12/87 - 17/1/91(38)	0.79
23	14	M	✓	81 - 82	7/81 - 7/83	1	22/7/81 - 2/82 (7)	0.43
24	15	M	✓	81-82,85-86,91-92,	3/81-12/82	1	3/81-2/82 (12)	0.08
25		"		"	"	W	8/85-5/86, 1/91-2/92 (24)	1.00
26	16	M	✓	86-89, 92-93, 96-99	6/86 - 8/90	W	9/9/86 - 12/89 (39)	0.56
27		"				S	3/96 - 11/99 (45)	0.38
28	17	M	✓	96-97, 93	93 + other odd times	S	3/96 - 3/8/97 (5)	1.60
29	18	M	✓	78-80,90-92,91-93,96-97	8/76-8/82	1	6/78-5/79, 6/79-5/80 (24)	0.42
30		"		"	"	W	4/90-6/92 (27)	0.04
31		"		"	"	S	3/96 - 8/97 (18)	0.00
32	19	M	✓	6/9/83-11/3/85	8/83-9/84	NA	NA - Outside TOR	NA
33	20	M	✓	81-82	1/81 - 1/83	1	13/1/81-2/82, (14)	0.29

EXP.0003.034

As at 21/03/01

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
2	12	3	0	0	0	3	1	4.00	4.00	2.38		
3	7	2	0	0	0	0	1	2.80	2.80	2.00		
4	0	0	0	0	0	0	0					
5	13	1	0	0	0	3	3	4.29	4.29	2.00	1	1
6	6	17	0	0	1	1	3					
7	8	0	0	0	0	0	4	5.00	5.00	2.00		
8	18	6	2	0	0	1	12					
9	0	3	0	0	0	0	0	4.38	4.77	2.08		
10	22	30	0	0	0	2	3					
11	0	0	0	0	0	0	0	3.60	3.33	2.00		
12	1	1	0	0	0	0	2					
13	0	3	0	0	0	0	5					
14	6	5	0	0	0	1	4	5.00	5.00	2.20		
15	0	0	0	0	0	0	0					
16	4	4	0	0	0	1	4	3.78	3.89	2.33		
17	1	1	0	0	0	0	4					
18	0	2	0	0	0	0	0	4.70	4.70	2.31		
19	23	19	22	0	0	0	3	5.00	5.00	2.00		1
20	17	5	1	0	0	4	2	4.75	4.83	2.31		
21	4	2	0	0	0	5	0	4.71	4.71	3.33		
22	24	0	0	0	0	2	4	4.46	4.69	2.00		
23	0	2	0	0	0	1	0	4.63	4.63	4.50		1
24	0	1	0	0	0	0	0	4.13	4.00	3.00		
25	0	10	1	0	3	2	8					
26	8	12	0	0	0	2	0	4.50	4.63	2.00		
27	8	3	0	0	1	0	5					
28	6	2	0	0	0	0	0	3.88	3.88	2.93		
29	3	3	1	0	0	0	3	4.63	6.00	4.33		
30	1	0	0	0	0	0	0					
31	0	0	0	0	0	0	0					
32	NA	NA	NA	NA	NA	NA	NA	3.43	3.43	2.08	1	1
33	1	0	1	0	0	1	1	4.00	4.00	2.50		

EXP.0003.035

As at 21/03/01

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
2		2							1	YES 1
3										NO
4										
5	1	2		1						YES 2,3
6										
7		1	1	1					1	YES 4
8										
9										0
10										
11				1						YES 1
12										
13										
14										NO
15										
16		1								YES 1
17										
18										YES
19		1								YES 1,2
20		1		1	1				1	YES 4,1,
21		2			1		3			YES 4,1
22				1						NA
23		1								YES 4
24				1	1		3		1	YES 4,4,4,1
25										
26		2		1			1	1	1	YES 1,4
27										
28		1		1		1	1		1	YES 1,4
29										NO
30										
31										
32										YES
33										NO

EXP.0003.036

MEDICAL

	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
2										
3										
4										
5	1		1							
6										
7				2	2				2	
8										
9										
10										
11	1									
12										
13										
14				1		1	1			
15										
16										
17										
18						1			1	
19										
20				1		1				
21				2			1		2	
22										
23		1		1						
24						1	1		3	
25										
26				1		1				
27										
28				1		1		1	2	
29										
30										
31										
32										
33				1						

As at 21/03/01

EXP.0003.037

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
2			5	0	2	1	1	1	0	0	0	NA
3			2	1	3	3	1	1	0	0	0	NA
4		3										
5	1		2	1	1	1	1	1	0	0	1	NA
6												
7	1		1	1	1	3	1	1	0	0	0	NA
8												
9			6	0	2	1	1	1	NA	NA	NA	NA
10		2										
11	1		5	0	2	1	1	1	0	0	0	NA
12												
13		3										
14			6	0	1	1	1	1	0	0	0	NA
15		1										
16			5	0	3	1	1	1	0	0	0	NA
17		2										
18		2	5	0	3	1	1	1	0	0	0	NA
19			5	0	3	2	1	1	0	0	1	NA
20			6	0	2	1	0	NA	NA	NA	NA	NA
21		1	5	0	1	1	1	0	0	1	1	NA
22		4	3	0	2	2	1	1	0	0	1	NA
23	1	3	2	1	3	1	0	NA	NA	NA	NA	NA
24	1		3	0	2	1	1	1	0	1	0	NA
25												
26			3	1	2	1	1	1	0	0	0	NA
27		3										
28	1		4	1	3	1	1	1	0	1	0	1
29			5	0	1	2	1	NA	NA	NA	NA	NA
30												
31		3										
32		NA	3	0	1	2	1	1	1	0	0	NA
33	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

EXP.0003.038

	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
34		"		"	"	W	8/85-3/6/86 (10)	0.00
35	21	M	✓	80 - 82	Sep-80	1	3/9/80 - 2/82 (18)	0.28
36	22	M	✓	81-82,88-89,	88-89	1	22/7/81 - 2/82 (7)	0.00
37		"		"	"	W	29/5/88-22/3/89, 23/3/89-6/92 (AR) (10)	0.10
38		"		"	"	S	3/96 - 11/99 (AR) (44)	0.02
39	23	M	✓	80 -82	Mid 80 - Early 81	1	6/2/80 - 2/82 (24)	1.04
40	24	M	✓	83	15/12/81 - 5/4/84	1,W	14/12/81-2/82, 8/85-8/86 (15)	0.00
41	25	M	✓	90-92, 91-92, 97-99	7/97-present	W	21/8/90 - 6/92 (23)	2.87
42		"		"	"	S	7/97 - 11/99 (28)	0.00
43	26	M	✓	87 - 89	82 - 87, & 89	W	19/8/87-6/10/87 (2), 3/7/89-21/9/89 (2), (4)	1.50
44	27	M	✓	80-82,85-89,91-92,91-93,96-99.	13/5/80 - 7/81	1	12/5/80 - 2/82 (22)	0.23
45		"		"	"	W	8/85 - 16/1/89 (42), 15/1/91 (18) (60)	0.27
46		"		"	"	S	3/96 - 28/7/99 (41)	0.17
47	28	M	✓	85 - 89	82 - 89	W	8?85 - 25/9/89 (50)	0.18
48	29	M	✓	80-82, 86-90	77-90	1	10/6/80 - 2/82 (19)	0.37
49		"		"	"	W	21/8/86 - 29/1/90 (53)	0.42
50	30	M	✓	81	Mar-82	W	8/85 - 12/6/89 (41)	0.59
51	31	M	✓	80-81	6/8/80-15/10/81	1	8/80 - 15/10/81 (14)	0.21
52	32	M	✓	85-91	85-86,86-87,87	W	8/10/85 - 26/2/91 (64)	0.39
53	33	M	✓	92-93, 96-99	92-00	S	3/96 - 11/99 (45)	0.49
54	34	M	✓	93, 96-99	89-00	S	3/96 - 11/99 (44)	1.16
55	35	M	✓	77 - 82	79	1	10/77 - 2/82 (53)	0.15
56	36	M	✓	86 - 91	2/86 - 9/91	W	2/86 - 9/91 (67)	0.69
57	37	M	✓	77-78,80-82,91-93,90-92	80-81, 90-91	1	10/77-31/5/78 (7), 21/11/80-2/82 (15), (22)	0.18
58		"		"	"	W	17/4/90 - 6/92 (26)	0.58
59	38	M	✓	77-81,85-86,88-92,91-93,96-99	89-92	1	10/77 - 5/1/81 (39)	0.03
60		"		"	"	W	8/85-19/5/86 (10), 12/1/88-6/92 (42)	0.21
61		"		"	"	S	3/96 - 11/99 (44)	0.18
62	39	M	✓	82-84	81 - 83	1	4/2/82-2/82 (1)	2.00
63		"		"	"	W	8/85-19/5/86 (10)	0.40
64	40	M	✓	77-78	No dates given	1	20/10/77 - 11/9/78 (11)	0.00
65	41	M	✓	77 - 90	79 - 81	1	10/77 - 5/10/81 (48)	0.19

EXP.0003.039

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
34	0	0	0	0	0	0	0					
35	2	3	0	0	0	0	0	2.50	2.50	2.00		
36	0	0	0	0	0	0	0	3.33	3.27	2.00		
37	0	1	0	0	0	0	0					
38	0	0	0	0	0	0	1					
39	9	9	0	0	1	2	4	4.25	19.00	NA		
40	0	0	0	0	0	0	0	4.50	4.67	4.50		
41	17	18	2	0	8	2	19	3.82	3.91	2.50	1	
42	0	0	0	0	0	0	0					
43	1	0	0	0	1	1	3	3.67	3.83	2.21		
44	3	0	0	0	0	1	1	4.40	4.40	3.50		
45	4	3	0	0	0	0	9					
46	0	3	0	0	0	2	2					
47	4	1	0	0	0	1	3	4.38	5.31	3.67		
48	2	3	0	0	0	1	1	2.91	3.67	2.33		
49	13	3	0	0	1	1	4					
50	7	8	4	0	0	0	5	3.33	3.80	1.83		
51	3	0	0	0	0	0	0	4.15	4.00	4.50		
52	14	7	0	0	0	3	1	0.38	0.38	0.00		
53	11	4	0	0	0	0	7					
54	25	15	1	0	2	1	7					
55	2	6	0	0	0	0	0	4.60	3.67	2.00		1
56	22	15	0	0	2	3	4	4.71	4.71	2.57		
57	2	0	0	0	0	0	2	3.79	3.79	3.14		
58	3	5	0	0	0	0	7					
59	0	1	0	0	0	0	0	ld Questionniare				
60	0	3	0	0	0	2	4	"				
61	1	5	0	0	0	1	1	"				
62	0	0	0	0	1	1	0	4.60	4.86	3.86		
63	1	2	0	0	0	1	0					
64	0	0	0	0	0	0	0	? Q8=5	NA	Q51=5		
65	5	2	2	0	0	0	0	4.71	5.00	4.33	1	

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
34										
35										YES1
36		1								YES 1
37										
38										
39			1						1	YES
40										NO
41		1	1	1	1	1	3		1	YES 1, 4
42										
43		1		1					1	YES 1
44		1		1						NO
45										
46										
47			1						1	YES
48		1						1		YES 1
49										
50				1	1					YES 4
51							2		1	YES 4
52										NO
53										
54										
55	1	1								NO
56		1							1	YES
57	1	1		1		1				YES 3,4
58										
59										
60										
61										
62		1		1		1			1	YES 1,1,4
63										
64										YES 1
65		1	1	1		1			1	YES 2,4

EXP.0003.041

	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
34										
35		1		1					1	
36										
37										
38										
39				1	1					
40										
41	1			1	1	1	1	1	3	
42										
43				1						
44				1						
45										
46										
47									3	
48										
49										
50										
51									1	
52										
53										
54										
55			1							
56		1		1	2	1	1			
57										
58										
59										
60										
61										
62				1						
63										
64										
65	1			1			1			

EXP.0003.042

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
34		2										
35		1	NA	0	2	1	1	1	0	0	0	NA
36			5	0	2	3	1	1	0	0	0	NA
37												
38		3										
39		2	6	0	3	2	1	1	0	1	0	NA
40		3	4	0	3	1	1	1	0	0	1	1
41	1		2	1	2	1	1	0	1	0	0	NA
42		2										
43	1	2	5	0	3	1	1	1	0	0	1	NA
44	1		4	0	3	1	1	1	0	0	0	NA
45												
46		2										
47	1	2	4	0	1	2	0	NA	NA	NA	NA	NA
48			3	1	2	1	1	1	0	0	0	NA
49		1										
50		2	6	0	2	1	1	1	0	0	0	NA
51		1	4	1	3	1	1	0	0	1	1	NA
52		2	6	0	3	1	1	1	0	0	0	NA
53		3										
54		2										
55		3	5	1	3	1	1	1	0	0	0	NA
56			4	1	2	1	1	1	0	1	1	1
57			6	0	2	1	0	NA	NA	NA	NA	NA
58												
59												
60												
61		4										
62	1		3	1	3	2	1	1	0	0	0	NA
63		2										
64		2	4	0	2	1	1	1	0	0	0	NA
65	1		4	1	2	1	1	1	0	0	0	NA

EXP.0003.043

MEDICAL

	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
66		"		"	"	W	17/1/89 - 1/10/90 (20)	0.00
67	42	M	✓	87-90,91	No dates given	W	20/7/87 - 16/4/90 (33)	0.64
68	43	M	✓	77-82,86,97-98,98-99.	78-80, & to 97	1	10/77 - 2/82 (52)	0.71
69		"				W	15/7/86 - 15/8/86 (1)	0.00
70		"				S	20/10/97 - 19/7/98 (9)	0.78
71	44	M	✓	91-92,91-93,96-99	89-00	W	9/7/91- 6/92 (12)	0.00
72		"		"	"	S	3/96 - 11/99 (45)	0.84
73	45	M	✓	87-87, 91-93	27/7/87-28/7/89	W	27/7/87-6/92 (60)	0.45
74	46	M	✓	79 - 82	81 - 82	1	13/2/79 - 2/82 (36)	0.00
75	47	M	✓	77-80	77-78	1	10/77 - 14/1/80 (27)	0.11
76	48	M	✓	81-82, 85-89, 89	No dates given	1	9/7/81 - 2/82 (8)	0.38
77		"		"	"	W	8/85-16/1/89 (42), 31/5/89-8/8/89 (2), (44)	0.45
78	49	M	✓	85-90	May-89	W	8/85 - 1/10/90 (62)	0.24
79	50	M	✓	92-93, 96-98	7/92-5/95	S	3/96-5/3/98 (24)	0.75
80	51	M	✓	81-82, 85-89	82	1	22/7/81-2/82 (7)	0.43
81		"		"	"	W	8/85 - 16/1/89 (42)	0.62
82	52	M	✓	88-92, 91-93	No dates given	W	25/5/88 - 6/92 (49)	0.16
83	53	M	✓	81 - 86	80 - 86	1	20/10/81 - 2/82 (4)	0.50
84		"		"	"	W	8/85 - 5/86 (9)	0.44
85	54	M	✓	89-92, 91-93	89-90	W	9/8/89 - 6/92 (35)	0.26
86	55	M	✓	87	1/86-1/88	1	10/77-15/8/78 (11), 8/1/81-2/82 (14), (25)	0.24
87		"		"	"	W	8/85-1/88 (29)	0.10
88	56	M	✓	85-88	3/83-3/85	W	8/85 - 11/1/88 (29)	0.31
89	57	M	✓	84	84 - 85	W	8/85 - 5/9/88 (36)	1.14
90	58	M	✓	81-82,85-87,90-92,91-93,96-99	81-82	1	25/5/81 - 2/82 (10)	0.40
91		"		"	"	W	8/85-30/6/87 (23), 17/7/90-6/92 (12), (35)	0.49
92		"		"	"	S	3/96 - 11/99 (45)	0.27
93	59	M	✓	87-92,91-93,96-99	86-98	W	7/4/87 - 6/92 (62)	0.79
94		"		"		S	3/96 - 11/1/99 (42)	0.67
95	60	M	✓	80-82, 85-87	79-present	1	12/5/80 - 2/82 (21)	0.43
96		"		"	"	W	8/85 -13/4/87 (20)	0.10
97	61	M	✓	85-92, 91-93	87-94	W	8/85 - 6/92 (82)	0.16

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
66	0	0	0	0	0	0	0					
67	6	13	0	0	0	0	2	5.00	5.40	2.00		
68	12	14	0	0	0	8	3	4.56	3.88	5.00		
69	0	0	0	0	0	0	0					
70	1	1	0	0	0	1	4					
71	0	0	0	0	0	0	0	3.64	3.07	2.00		
72	12	21	0	0	0	0	5					
73	7	13	1	0	0	1	5	4.42	4.80	4.00		
74	0	0	0	0	0	0	0	4.00	4.00	2.25		
75	1	2	0	0	0	0	0	3.14	3.33	2.15		
76	0	3	0	0	0	0	0	4.40	5.00	4.00		
77	16	1	2	0	0	0	1					
78	12	0	0	0	0	0	3	3.67	2.67	2.08		
79	0	7	0	0	2	2	7					
80	0	1	0	0	0	1	1	4.00	3.71	2.54		
81	11	10	0	0	0	1	4					
82	3	3	0	0	0	1	1	2.38	3.92	2.00		
83	0	1	0	0	0	0	1	5.00	5.00	1.00	1	
84	2	1	0	0	0	0	1					
85	3	2	1	0	0	2	1	3.25	3.38	2.08		1
86	2	3	0	0	0	0	1	3.33	3.31	2.00		
87	1	1	0	0	0	0	1					
88	4	3	0	0	0	0	2	4.00	4.00	2.46		
89	12	25	0	0	0	0	4	3.11	3.33	2.00		
90	2	0	0	0	0	0	2	3.80	3.80	2.00	1	
91	13	1	0	0	0	1	2					
92	3	1	0	0	0	1	7					
93	18	17	0	0	0	2	12	3.33	3.33	2.00		
94	8	5	2	0	3	3	7					
95	2	5	0	0	0	2	0	4.43	4.43	4.17		
96	0	1	0	0	0	0	1					
97	5	2	0	0	0	0	6	3.11	2.89	2.14		

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
66										
67		1								NO
68			1				3		1	YES 4
69										
70										
71			1			1	2		1	YES 4
72										
73		2	1	1		1			1	YES 4,1
74										NO
75										NO
76										YES
77										
78										NO
79										
80										NO
81										
82										YES
83	1								1	YES
84										
85									1	YES 2
86										YES
87										
88		1		1				1	1	YES 1, 4
89										YES
90										YES
91										
92										
93										NO
94										
95		2			1		1		1	YES 1,
96										
97										YES

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	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
66										
67				1						
68										
69										
70										
71										
72										
73				1	1	1				
74										
75				1						
76				1						
77										
78										
79										
80										
81										
82										
83			1	1			1			
84										
85		1								
86	1			1						
87										
88							1			
89										
90	1		1							
91										
92										
93										
94										
95				1					1	
96										
97										

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
66		1										
67			6	0	3	1	1	1	0	0	0	NA
68			2	1	3	3	1	1	0	0	0	1
69												
70		1										
71			3	0	3	1	0	NA	NA	NA	NA	NA
72		3										
73	1		3	0	2	1	1	0	NA	NA	1	NA
74		1	6	0	2	1	0	NA	NA	NA	NA	NA
75	1	2	6	0	2	1	1	1	0	0	1	NA
76	1		4	0	2	2	1	1	0	0	0	NA
77		2										
78		2	5	0	3	1	0	NA	NA	NA	NA	NA
79		2										
80			5	0	2	1	1	1	0	0	0	NA
81		1										
82			6	0	2	1	1	1	0	0	0	NA
83	1		4	0	3	1	0	NA	NA	NA	NA	NA
84		2										
85			6	0	3	1	1	1	0	0	0	NA
86	1		6	0	3	2	1	1	0	0	0	NA
87		2										
88		1	5	0	3	1	1	1	0	0	0	NA
89		2	5	0	2	2	1	1	0	0	0	NA
90	1		5	0	2	1	1	1	0	0	0	NA
91												
92		1										
93			5	0	3	1	0	NA	NA	NA	NA	NA
94		2										
95	1		6	1	3	1	1	1	1	1	1	1
96		2										
97			4	0	2	1	1	1	0	0	0	NA

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	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
98	62	M	✓	8/85 - 5/86	9/83 - 5/86	W	8/85 - 5/86 (9)	0.00
99	63	M	✓	85-87, 89	84-86	W	8/85-7/12/87 (28), 25/8/89-28/9/89 (1), (29)	0.86
100	64	M	✓	81-82, 85-89	8/82-3/84	1	26/11/81-2/82 (3)	0.00
101		"		"	"	W	8/85-2/8/89 (48)	0.79
102	65	M	✓	86-90,93-94,94-00	No dates given	W	11/9/86-27/12/90 (51)	0.78
103		"		"	"	S	19/9/94 - 11/99 still serving (62)	0.89
104	66	M	✓	8/80-2/82, 8/85-6/92	84-86	1	6/8/80 - 2/82 (18)	0.28
105		"		"	"	W	8/85 - 6/92 (82)	0.27
106	67	M	✓	79-82, 85-87, 96-97	No dates given	1	26/6/79 - 2/82 (32)	0.19
107		"		"	"	W	8/85 - 19/1/87 (18)	0.06
108		"		"	"	S	3/96 - 14/7/97 (17)	0.24
109	68	M	✓	85-92, 91-92	Dec-85	W	12/12/85 - 13/18/92 (73)	0.23
110	69	M	✓	89-92, 91-93, 96-99	7/89 - 4/90	W	4/7/89 - 6/92 (35)	0.49
111		"		9/96 - 11/99	"	S	3/96 - 11/99 (44)	0.57
112	70	M	✓	78-82,88-92,91-93.	5/88 - 6/91	1	1/7/78 - 8/2/82 (43)	0.00
113		"		"	"	W	29/5/88 - 6/92 (50)	0.22
114	71	M	✓	81-83	3/81-12/82	1	9/3/81-2/82 (12)	0.33
115		"		"	"	W	8/85-27/9/86, 23/3/92-1/7/92 (16)	0.75
116		"		"	"	S	16/7/96 - 8/10/97 (15)	0.80
117	72	M	✓	92-93, 96-97	89-91, 96-00	S	3/96 - 10/8/97 (17)	0.18
118	73	M	✓	87-92	No dates listed	W,N	8/12/87 - 6/92, 4/91 - 17/12/92 (76)	0.01
119	74	M	✓	77-79, 92, 93.	78 -79	1	10/77 - 21/10/79 (24)	0.58
120	75	F	✓	90-92,91-93,96-99	3/92-2/94	W	25/9/90 - 6/92 (21)	0.57
121		"		"	"	S	3/96 - 11/99 (44)	0.00
122	76	M	✓	Aug-89	Oct-89	W	1/8/89 - 22/8/89 (1)	0.00
123	77	M	✓	89-92, 91-93, 96-99	1/98-5/98	W	1/12/89 - 6/92 (30)	0.23
124		"				S	3/96 - 11/99 (44)	0.27
125	78	M	✓	79-82, 85-89	6/82-3/84	1	2/1/79-2/82 (26)	0.00
126		"		"	"	W	8/85-6/12/88 (43)	0.32
127	79	M	✓	80-81	3/80 - 8/81	1	28/3/80 - 2/82 (24)	0.21
128		"		"	"	W	8/85 - 27/6/88 (35)	0.17

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
98	0	0	0	0	0	0	0	4.17	4.67	2.00		
99	14	7	0	0	1	0	3	4.67	5.00	2.08		1
100	0	0	0	0	0	0	0	3.86	4.29	2.00		
101	10	21	0	0	2	1	4					
102	22	13	1	0	0	0	4	3.40	3.00	2.08		
103	10	33	0	0	0	0	12					
104	2	3	0	0	0	0	0	3.86	4.00	2.20		
105	11	5	0	0	0	2	4					
106	2	3	0	0	0	1	0	3.23	3.00	2.23		
107	0	1	0	0	0	0	0					
108	3	1	0	0	0	0	0					
109	4	8	0	0	0	3	2	3.44	3.44	2.00		
110	4	4	0	0	0	1	8	ld questionaire				
111	9	6	0	0	0	1	9					
112	0	0	0	0	0	0	0	3.86	3.33	2.00		
113	2	4	0	0	1	1	3					
114	1	0	0	0	0	3	0	3.63	3.75	2.75		1
115	7	4	1	0	0	0	0					
116	6	1	0	0	0	0	5					
117	0	3	0	0	0	0	0					
118	0	1	0	0	0	0	0	2.31	2.31	2.00		
119	1	6	0	0	0	3	4	5.00	5.00	4.25		2
120	5	6	0	0	0	0	1	2.78	2.45	2.00		
121	0	0	0	0	0	0	0					
122	0	0	0	0	0	0	0	3.13	3.13	2.00		
123	1	4	0	0	0	0	2	1.14	1.43	0.79		
124	6	0	0	0	0	2	4					
125	0	0	0	0	0	0	0	6.00	6.00	3.00		1
126	13	8	0	0	0	0	2					
127	0	4	0	0	0	1	0	4.50	4.50	3.75		
128	4	0	0	0	0	2	0					

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
98		1				1			1	NO
99										YES 2
100		1						1		NO
101										
102										NO
103										
104										YES
105										
106		2		1				1		YES 1,4
107										
108										
109		1								NO
110										
111										
112								1		NO
113										
114			1	1				1	1	NO
115										
116										
117										
118										NO
119		3		1			2			YES 1,4
120		1		1		1			1	YES 1,4
121										
122				1						NO
123										YES
124										
125										NO
126										
127				1						YES 4
128										

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	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
98				1						
99	1					1				
100			1	1		1	1			
101										
102										
103										
104									1	
105										
106				1						
107										
108										
109										
110										
111										
112			1							
113										
114			1						1	
115										
116										
117										
118										
119				1		1				
120	1			1						
121										
122										
123										
124										
125		1							1	
126										
127						1				
128										

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
98	1	2	3	NA	3	1	1	1	NA	NA	NA	NA
99	1	3	3	0	3	1	1	1	0	0	0	1
100	1		5	0	2	1	1	1	0	0	1	NA
101		1										
102			2	0	3	1	0	NA	NA	NA	NA	NA
103		3										
104	1		6	1	2	1	1	1	0	0	0	NA
105		1										
106	1		6	0	3	3	1	1	0	0	0	NA
107												
108		1										
109			5	0	3	3	1	1	0	0	0	NA
110												
111		2										
112			3	0	2	3	1	1	0	0	0	NA
113												
114	1		5	0	2	3	1	1	0	0	0	NA
115												
116		1										
117		1										
118		2	6	0	1	1	1	0	0	0	1	NA
119			5	1	2	1	1	1	0	0	0	NA
120	1		2	1	2	2	1	1	0	0	0	1
121		2										
122		2	3	1	2	1	0	NA	NA	NA	NA	1
123			4	1	3	1	1	1	0	0	0	NA
124		2										
125			4	0	3	1	0	NA	NA	NA	NA	NA
126		3										
127	1		2	1	1	3	0	NA	NA	NA	NA	NA
128		1										

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MEDICAL

	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
129	80	M	✓	5/93-8/93, 3/96-11/99	05/93-present	S	03/96 - 11/99 (45)	0.16
130	81	M	✓	86-92,96,97-99	88 - 89	W	17/4/86 - 13/1/92 (33)	0.70
131		"		"	"	S	3/96 - 28/4/96 (2), 16/6/97 - 28/1/99 (8), (10)	0.90
132	82	M	✓	79-82	No dates given	1	15/6/79 - 2/82 (32)	0.28
133	83	M	✓	85-89,89,96-97	73-78, 83-88	W	8/85-17/1/89 (41), 10/5/89-16/5/89 (1), (42)	0.38
134		"		"	"	S	3/96/5/3/97 (12)	0.75
135	84	M	✓	76-78	78	1	7/12/76 - 15/12/78 (24)	0.17
136	85	M	✓	77-79, 85-88	74-79	1	10/77 - 25/7/79 (22)	0.73
137		"		"	"	W	8/85 - 11/1/88 (29)	0.28
138	86	M	✓	96-99	97	S	3/96 - 11/99 (33)	0.73
139	87	M	✓	88-92, 91-93	early 90's	W	4/7/88-6/92 (48)	0.50
140	88	M	✓	82-85	82, 85	1	4/2/82-2/82 (1)	1.00
141		"		"	"	W	8/85-9/86 (13)	0.15
142	89	M	✓	86-90, 96-99	86-present	W	24/2/86 - 164/90 (50)	0.40
143		"		"	"	S	3/96 - 11/99 (45)	0.87
144	90	M	✓	85-88	9/83 - 5/86	W	8/85 - 11/1/88 (29)	0.41
145	91	M	✓	77-82	10/77 - 2/82 (52)	1	10/77 - 2/82 (52)	0.25
146	92	M	✓	81-82, 85-87	7/76-78, 90-93	1	7/6/81-2/82 (8)	0.13
147		"		"	"	W	8/85 - 20/5/87 (29)	0.41
148	93	M	✓	85-92,91-93,96-97,97-99.	1/8/83 - 6/85	W	8/85-6/92 (83)	0.36
149		"		"	"	S	3/96-14/1/97 (9), 15/9/97-30/9/99 (25), (34)	0.74
150	94	M	✓	83-84	10/83 - 7/85	W	6/12/83 - 24/7/84 (NA)	N/A
151	95	M	✓	03/96 - 11/99	07/90 - present	s	3/96 - 11/99 (44)	0.25
152	96	M	✓	77-82, 85-88	77-88	1	10/77-2/82 (53)	0.43
153		"		"	"	W	8/85-14/12/87 (26)	0.73
154	97	M	✓	80-82	end 80-early 82	1	23/4/80 - 2/82 (22)	0.95
155	98	M	✓	77-82, 85-87	No dates given	1	10/77 - 2/82 (53)	0.43
156		"		"	"	W	8/85 -11/87 (17)	0.35
157	99	M	✓	84-85	3/84 - 7/86	W	8/85 - 13/10/88 (38)	0.11
158	100	M	✓	85-91	4/85 - 3/91	W	8/85 - 18/3/91 (67)	0.24
159	101	M	✓	79-82, 86-89	No dates given	1	8/5/79 - 11/1/82 (32)	0.06
160		"		"	"	W	21/8/86 - 13/9/89 (37)	0.22

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
129	2	5	0	0	0	0	0					
130	7	14	0	0	0	2	0	4.20	4.50	2.00		
131	6	1	0	0	0	2	0					
132	3	5	0	0	0	0	1	4.13	4.11	4.00		
133	6	2	1	0	0	3	4	4.71	4.75	5.00		
134	4	2	3	0	0	0	0					
135	0	1	0	0	0	3	0	4.00	4.75	2.23		
136	2	2	0	0	1	1	10	4.00	4.88	2.46		1
137	3	5	0	0	0	0	0					
138	9	6	1	0	1	0	7	3.78	3.89	2.21	1	
139	15	6	0	0	0	2	1	2.38	2.38	NA		
140	0	0	0	0	0	1	0	4.83	4.86	3.00		
141	0	2	0	0	0	0	0					
142	6	13	0	0	0	0	1	2.77	2.77	2.00		
143	21	16	0	0	0	1	1					
144	8	1	0	0	0	0	3	2.85	2.93	2.08		
145	2	3	1	0	1	1	5	3.57	4.80	3.00		
146	0	0	0	1	0	0	0	4.08	4.09	2.83		
147	2	4	0	1	0	0	5					
148	9	16	0	0	1	0	4	3.55	3.31	2.77		1
149	9	5	2	0	1	3	5					
150	0	0	0	0	0	0	0	5.50	4.71	5.00		
151	4	4	0	0	0	0	3					
152	4	8	0	0	0	3	8	4.33	4.33	3.80		
153	6	8	0	0	0	1	4					
154	15	1	0	0	0	0	5	5.00	5.00	2.08		
155	3	6	0	0	0	0	14	0.00	0.00	2.00		
156	1	1	0	0	0	0	4					
157	2	2	0	0	0	0	0	4.20	4.30	2.00		
158	9	6	0	0	0	0	1	3.60	2.90	2.00		
159	2	0	0	0	0	0	0	3.00	2.42	2.00		
160	4	2	0	0	0	0	2					

EXP.0003.055

MEDICAL

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
129										
130				1						NO
131										
132	1	1				1			1	YES 1
133		1		1						YES 1,4
134										
135		1							1	YES 1
136		1		1	1	1				YES 1,4
137										
138			1	1	1		4		1	YES 4
139										NO
140	1		1			1				NO
141										
142										NO
143										
144	1	1		1				1		NO
145				1					1	YES 1
146										YES 4
147										
148		1		1		1				YES 1,3
149										
150			1	1					1	YES 4
151										
152		2		1		1			1	YES 1
153										
154	1	1		1				1		YES
155										NO
156										
157										YES 1,4
158										NO
159										NO
160										

As at 21/03/01

EXP.0003.056

	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
129										
130										
131										
132				1						
133				1						
134										
135				1						
136				1			1		1	
137										
138										
139										
140			1							
141										
142										
143										
144				1						
145				1		1				
146			1	1	1				1	
147										
148				1			1			
149										
150					1	1				
151										
152				1	1	1		1		
153										
154			1				1		1	
155										
156										
157										
158										
159										
160										

EXP.0003.057

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
129		1										
130			6	0	1	1	1	1	0	0	0	NA
131		3										
132	1	2	1	1	2	1	1	1	NA	1	NA	1
133			5	0	2	1	1	1	NA	NA	1	NA
134		1										
135		2	5	0	3	1	0	NA	NA	NA	NA	NA
136	1		4	0	1	1	1	1	0	0	0	NA
137		3										
138		1	3	1	2	1	1	1	0	0	0	NA
139			6	0	2	1	1	1	0	0	0	NA
140	1		5	0	3	1	1	1	0	0	0	NA
141		2										
142			3	0	3	1	1	1	0	1	0	1
143		1										
144		3	5	1	2	1	1	1	0	1	1	NA
145	1	3	3	1	3	1	1	1	0	0	0	1
146	1		3	1	3	3	1	1	1	NA	NA	NA
147		2										
148			4	0	2	1	1	0	1	1	0	1
149		3										
150	1	NA	3	1	2	1	0	NA	NA	NA	NA	NA
151		3										
152	1		3	1	1	1	1	1	0	0	0	NA
153		3										
154	1	NA	2	1	2	1	1	NA	NA	1	NA	1
155			4	0	3	3	?	1	0	0	0	NA
156		2										
157		1	5	0	2	3	0	NA	NA	NA	NA	NA
158		1	4	0	3	1	1	1	0	0	0	NA
159			6	0	3	1	1	1	0	0	0	NA
160		2										

EXP.0003.058

	A	B	C	D	E	F	G	H
1	No	SEX	PRE's	Period Of Involvement (PRE)	Period Of Involvement (HQ)	PROGRAM 1, N, S, W	CONFIRMED PERIOD OF INVOLVEMENT (NA) Outside TOR	MEDICAL PRESENTAIONS AVERAGE
161	102	M	✓	85-87	1/85-3/87	W	8/85 - 16/3/87 (19)	0.16
162	103	M	✓	88-92, 91-93, 96-99	88-91	W	6/1/88 - 6/92 (53)	0.25
163		"		"	"	S	3/96 - 11/99 (44)	0.14
164	104	M	✓	80-82,86-92,91-93,96-97	80-97	1	15/1/80 - 2/82 (26), 12/10/78-31/10/78 (1), (27)	0.30
165		"		"		W	25/11/86 - 6/92 (67)	0.64
166		"		"		S	3/96 - 13/1/97 (9)	1.33
167	105	M	✓	77-82, 85-91	No dates given	1	10/77 - 2/82 (52)	0.73
168		"		"	"	W	8/85 - 14/1/91 (65)	0.48
169	106	M	✓	89	29/5/88 - 5/9/89	W	30/5/89 - 29/8/89 (3)	0.67
170	107	M	✓	85-86,92-93,96-99	83-85	W	8/85-9/86 (13)	0.08
171		"		"	"	S	3/96 - 11/99 (44)	0.00
172	108	M	✓	80-82,85-86,91-92,91-93,98-99	80-95	1	7/7/80 - 17/2/82 (19)	0.26
173		"		"	"	W	8/85 - 25/11/86 (15), 15/21/91-6/92 (17), (32)	0.16
174		"		"	"	S	8/1/98 - 11/99 (22)	0.00
175	109	M	✓	77-82, 85-89, 89-99	75-88	1	10/77 - 2/82 (52)	0.81
176		"		"	"	W	8/85-7/3/89 (43), 8/3/89-6/92 (AR) (39)	0.26
177		"		"	"	S	3/96 - 11/99 (AR) (44)	0.05
178	110	M	✓	79-82	30/10/79-10/8/82	1	30/10/79 - 2/82 (28)	0.25
179								

EXP.0003.059

	I	J	K	L	M	N	O	P	Q	R	S	T
1	INFECTION	TRUMA	ALLERGIC	NEOPLASTIC	PSYCHIATRIC/ NEUROLOGICAL	CHEMICAL	OTHER	SKIN EXPOSURE Q07-22	INHALATION EXPOSURE Q30-46	EYE SPLASH EXPOSURE Q50-66	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Sinus Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Eye Symptoms
161	0	3	0	0	0	0	0	3.60	3.67	2.40		1
162	4	5	0	0	0	1	3	3.90	4.83	NA		
163	1	3	0	0	0	0	2					
164	0	6	0	0	0	1	1	4.29	4.14	2.21		
165	26	7	1	0	0	2	7					
166	9	0	0	0	0	0	3					
167	28	1	3	0	0	3	3	2.92	2.85	2.08		
168	12	9	9	0	0	0	1					
169	1	1	0	0	0	0	0	5.00	5.00	2.60		1
170	1	0	0	0	0	0	0	2.62	2.62	2.46		
171	0	0	0	0	0	0	0					
172	3	0	0	0	0	2	0	3.07	3.13	2.08		
173	1	3	1	0	0	0	0					
174	0	0	0	0	0	0	0					
175	24	7	0	3	2	6	0	3.00	3.38	2.80		
176	5	2	0	0	0	0	3					
177	0	0	0	0	0	0	2					
178	2	3	0	0	0	0	2	3.67	3.67	2.46		1
179										TOTALS	7	16

EXP.0003.060

	U	V	W	X	Y	Z	AA	AB	AC	AD
1	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Chest Difficulties	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Gastro / Intestinal Symptoms	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Headaches	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Memory Loss	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Dizzyness	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Mood & Neuro Disorders	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Skin Odour	SYMPTOMS - AT TIME OF EXPOSURE - Q67-Q74 Consulted Health Professional	WITNESS SYMPTOMS -AT TIME OF SERVICE (FROM WITNESS STATEMENT)
161		1		1		1				YES 1,
162										NO
163										
164		1							1	YES 1
165										
166										
167										NO
168										
169				1		1				NO
170				1					1	NO
171										
172		1								NO
173										
174										
175		1		1					1	YES 1,4
176										
177										
178		1		1		1				YES 1,4
179	8	53	12	38	8	17	25	9	32	TOTALS

EXP.0003.061

	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Sinus Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Eye Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Chest Difficulties	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Gastro / Intestinal Symptoms	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Headaches	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Memory Loss	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Dizzyness	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Mood & Neuro Disorders	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Skin Odour
161				1						
162										
163										
164										
165										
166										
167										
168										
169		1								
170						1				
171										
172										
173										
174										
175	1			1		1	1			
176										
177										
178				1						
179	9	6	10	42	10	18	13	3	25	0

EXP.0003.062

	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	SYMPTOMS - SINCE LEAVING THE PROGRAM - Q80 - Q90 Consulted Health Professional	CURRENT STATE OF HEALTH Q92	HOW OFTEN DID YOU CONSULT A DR. Q93	CURRENT THERAPY Q94 (1)=Yes (0)=No	PLAY SPORT Q96	EMPLOYED Q97	CHILDREN Q98 (1)=Yes (0)=No	HEALTH Q99 (1)=Yes (0)=No	BIRTH DEFECT Q100 (1)=Yes (0)=No	DEVELOPMENTAL PROBLEMS Q101	ALLERGIE S Q102	OTHER Q103
161		1	4	0	3	1	1	0	1	1	1	NA
162			6	0	2	1	1	1	0	0	0	NA
163		2										
164			4	0	3	1	1	1	NA	NA	NA	1
165												
166		3										
167			2	1	2	1	1	1	0	0	0	NA
168		1										
169	1	1	6	0	3	1	0	NA	NA	NA	NA	NA
170	1		6	0	2	1	1	1	0	0	0	NA
171		1										
172			6	0	2	1	1	1	0	0	0	NA
173												
174		2										
175	1		3	1	3	1	1	1	0	0	0	NA
176												
177		2										
178	1		6	0	3	1	0	NA	NA	NA	NA	NA
179	40											

EXP.0003.063

APPENDIX 6 -

Additional symptoms from the structured Interview/Questionnaire

APPENDIX 6

ADDITIONAL SYMPTOMS AND DIAGNOSIS FROM THE HEALTH QUESTIONNAIRE AT TIME OF EXPOSURE

- Ankylosing spondylitis
- Hepatitis B
- Migraine
- Alopecia x 2
- Haematuria
- Boils x 2

COMMENTS WITH CHEMICAL REFERENCE

- Diarrhoea when using SR51
- Headaches with MEK
- Eye splash R148
- Eye splash SR51
- Skin symptoms MEK

AT TIME OF QUESTIONNAIRE DIAGNOSES

- Multiple sclerosis
- Ankylosing spondylitis
- Diverticulitis
- Arthritis x 3
- Nephritis
- Diabetes Type II
- Psoriasis
- Breast cancer
- Anaemia
- Hypertension
- Migraine
- Liver disease
- Skin cancer
- Chronic fatigue
- Colon polyp
- Benign tumour
- Heart problems x 2
- Sun spots

- Fungal rash
- Blood disorders

SYMPTOMS

- Night sweats
- Failing eye sight x 2
- Haematuria
- Chest pain
- Lumps
- Blemish in the eye
- Bone pain
- Alopecia

COMMENTS

- Symptoms due to exposure to chemicals
- Stay out of fuel tanks

NAME: ERIC DONALDSON

DATE OF BIRTH: 7TH April 1936

PLACE OF BIRTH: Cloncurry, Queensland

MARRIED: December 1961

ACADEMIC QUALIFICATION:

B A University of Queensland 1957
M B B S University of Melbourne 1963
Dip Av Med (RCSE and RCPL) UK 1973
M S (Aerospace Medicine) Wright State University 1981
D Univ. Griffith University 1998

MEMBERSHIP OF LEARNED SOCIETIES:

F A F O M Foundation Fellow of the Australasian College of Occupational Medicine 1983

Fellow of Australasian Faculty of Occupational Medicine 1994

F R Ae S Fellow of Royal Aeronautical Society

Fellow in Aerospace Medicine 1987
(Aerospace Medical Association)

Member of the International Academy of Aviation and Space Medicine 1982.
Selector 1989-93
Scholarship Committee Chairman 1996-01
2nd Vice President 1999-01

Member of International Aviation Medical Directors Advisory Council 1989- 01
Secretary - 1994
Chairman - 1996

Member Aviation Medical Society of Australia and New Zealand.
Committee Member 1972 - 93
President 1981 - 84

Member of Airlines Medical Directors Association 1991 -2001.
Vice President 1994. President 1996

MEDICAL APPOINTMENTS:

1964 Resident Medical Officer, Maryborough Base Hospital

1965 - 69 Lecturer & Teaching Registrar, University of Queensland

1969 - 79	Regimental Medical Officer, Jungle Training Centre, Canungra
1970	Medical Officer, 8 Field Ambulance, Nui Dat, South Vietnam.
1971	Regimental Medical Officer, First Aviation Regiment, Oakey, Queensland.
1973	Post-graduate training in Aviation Medicine, Institute of Aviation Medicine, Farnborough, UK
1974 - 80	Senior Medical Officer, Army Aviation Centre, Oakey, Queensland
1981	Resident in Aerospace Medicine, Department Of Community Medicine, Wright State University, Dayton, Ohio.
1982 - 84	Senior Medical Officer, Army Aviation Centre, Oakey, Queensland.
1985 - 87	Director Army Malaria Research Unit
1987	Consultant to Health Department of NSW on Aeromedical Transport by Helicopter.
1988	Army Office Special Project Officer for Aviation Medical Training for the Army.
1989 - 99	Qantas General Manager, Aviation Health Services
1999-01	Adjunct Professor Aerospace Medicine, Griffith University.

AVIATION MEDICINE APPOINTMENTS:

1974 - 01	Designated Aviation Medical Examiner for the Civil Aviation Safety Authority.
1974 - 84	Adviser in Aviation Medicine to the Director of Medical Services - Army.
1985 - 96	Army Office Consultant in Aviation Medicine.
1977 - 89	Visiting Lecturer in Aviation Medicine, Department of Social and Preventive Medicine, University of Queensland.
1982 - 94	Visiting Lecturer in Aviation Physiology, Department of Anaesthetics, University of Queensland.
1978 - 82	Member of the Medical Advisory Sub-Committee on the use of Aerial Transport, Queensland government Department of Health
1982 - 91	Member of Medical Advisory Panel of Surf Life Saving Association (Queensland Division).

1989 - 98	Member of National Medical Advisory Committee of Surf Life Saving Association.
1986 - 89	Defence Force member Australian Standards Human Factors Group.
1989 - 98	Honorary Sydney Medical Adviser for the Guild of Air Pilots and Air Navigators.
1993 -95	International Air Transport Association Medical Adviser.
1991 - 00	Visiting Lecturer and Committee Member Monash University - Australian Certificate of Civil Aviation Medicine Course.
1995 - 01	Committee Member Australian Standards AV/11 Aircraft and Helicopter Noise.
2000- 01	Member of Advisory Committee of the Centre for Aviation Medicine and Human Factors Research.

EXECUTIVE MEDICAL POSITIONS

1973 - 93	Committee Member Aviation Medical Society of Australia and New Zealand.
1978 - 81	Vice-President Aviation Medical society of Australia and New Zealand.
1981 - 84	President Aviation Medical Society of Australia and New Zealand.
1984 - 96	Member on International Committee of the Aerospace Medical Association, USA.
1986 - 88	Chairman of Committee for the 36th Congress of the International Academy of Aviation and Space Medicine.
1987 & 1996	Vice-President Aerospace Medical Association
1992 - 01	Member of Air Transport Committee of Aerospace Medical Association.
1988 - 94	Member of Resolutions Committee of the Aerospace Medical Association.
1988 - 93	Member of Membership Committee of the Aerospace Medical Association.
1994	Secretary International Aviation Medical Directors' Advisory Council.
1996	Chairman International Aviation Medical Directors' Advisory Council.

	1994	Vice-President Airline Medical Directors Association
	1996	President Airline Medical Directors Association
	1999- 01	2[ND] Vice-President International Academy of Aviation and Space Medicine.
	2000- 01	Chairman of Committee for the 50th Congress of the International Academy of Aviation and Space Medicine

SERVICE COURSES:

Aviation Medicine Instructor's Course - RAAF Point Cook

Aviation Medicine Diploma Course RAF Institute of Aviation Medicine, Franborough, UK.

Senior Officers' Aviation Medicine Course - RAF IAM, Farnborough, UK.

Survival Training - School of Combat Survival and Rescue RAF, Mount Batten, UK.

Underwater Escape Training - RN Portsmouth UK.

Basic Flying Training (130 Hours Chipmunk) - RAF Glasgow University Air Squadron.

Advance Flying Training Course (206B1 Light Observation Helicopter) -School of Army Aviation, Oakey, Queensland.

Water Descent - Parachute Training School, Williamstown, NSW.

Defence Force Medical Officers Introductory Nuclear Biological Chemical Course.

CIVILIAN COURSES:

Certificate of Medical Training, Aviation Medicine - Civil Aeromedicine Institute, Oklahoma, USA 1981.

Master of Science Course in Aerospace Medicine at Wright State University, Ohio, USA, 1981.

Financial Management 1992, Accounting and Budgeting 1993, University of Technology, Sydney.

PUBLICATIONS:

E Donaldson, P Morwood, W Whiting
"The Effects of Pregnancy and Wounding on the Mast Cell Population of the Rat Uterus", Aust and NZ Journal of Obstetrics and Gynaecology, Vol.7 no.4.

E Donaldson, J Grant-Thomson, P Morwood, N O'Connor

"Preliminary Reports in Stress Evaluation in Australian Army Helicopter Pilots". ASCC Proceeding for 19th Meeting, Vol. 3

E Donaldson, J Grant-Thomson, P Morwood, N O'Connor, R Tippett
"Pilot Study on the Value of a Beta Blocking Drug in Initial Helicopter Training." Aviation Space and Environmental Medicine Vol.51, No.9, Sept. 1980

E Donaldson
"Preliminary Investigation of the Variation of some Dark Adaptation Aspects of Possible Relevance to Military Helicopter Aircrew". US Air Force Aerospace Medical Research Laboratory Report TR-83-053.

E Donaldson
"Heat Stress Limitations for NBC Clothing". Proceedings of Commonwealth Defence Conference on Operational Clothing and Combat Equipment.

E Donaldson, D Kennaway
"Tamazepam and Jet Lag: Effects on Sleep, Performance and Rhythmic 6 - Sulphatoxymelatonin and Cortisol excretion following travel across 11 time zones". Aviation Space and Environmental Medicine Vol 62, No.7, July 1991.

E Donaldson, J Pearn
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E Donaldson
"First Aid in the Air". Chapter in "The Science of First Aid". St. John Ambulance 1996

Michael F O'Rourke, MD, DSC, Eric Donaldson, MB, FAFOM, John S Geddes, MD, FRCP
"An Airline Cardiac Arrest Program". Circulation Vol.96, No.7

E Donaldson, I Morrison, J Putland

"Medical Emergencies on Commercial Aircraft". Medicine Today April 2000

REPORTS:

E Donaldson
"Enquiry into Aeromedical Transport by Helicopter in NSW". Department of Health of NSW

PAPERS READ BY INVITATION:

"Helicopter Evacuation" - Royal Australasian College of Surgeons

"Role of the Helicopter in Pre-Hospital Care"-Royal AustralasianCollege of Surgeons (Queensland Division)

"Aeromedical Transport" - Royal Australian College of General Practitioners.

"Parachuting and the Naso Pharynx" - New Zealand Branch of Aviation Medical Society of Australia and New Zealand and Queentown.

"The use of Temazepam in the Management of Air Travel Fatigue" - International Symposium Modern Hypnotics and Performance at Nuremburg.

"Travel Considerations for Cardiac Patients" - 44th Annual Scientific Meeting of the Cardiac Society of Australia and New Zealand.

"In Flight Care" - Annual Scientific Meeting of Queensland Branch of Royal Australasian College of Physicians.

"Teaching Defibrillation at QANTAS" - 2nd International "Spark of Life" Conference.

"Defibrillation - The QANTAS Experience" Public Access Defibrillation - National Heart Foundation.

"QANTAS - Medicine in the Air" Australian and New Zealand College of Anaesthetics Annual Scientific Meeting.

RESEARCH PRESENTATIONS:

Principal author of the following presented at Scientific Meetings of the Aviation Medicine Society of Australia and New Zealand;

1980*	Physiological Measurements during Helicopter Flight
1980	Do Beta Blockers have a place in Helicopter Training?
1981*	Pilots' Night Vision
1982	Otic Barotrauma and the Parachutist
1982*	Measurement of Heat Stress and Strain in Army Aircraft
1982*	Variability of Pilot Night Vision
1982*	Function of the Eustachian Tube during rapid descent
1982*	Preliminary Report on the Naso Pharyngeal Pressures in the Free Fall Parachutist
1983*	Barotrauma and the Halo Parachutist
1986*	Malaria Prophylaxis for Aircrew
1988*	Study of the Effects of Temazepan in the Management of Jet Lag
1991*	Defibrillation in flight

Presentations at the Scientific Sessions of The American Heart Association and The American College of Cardiology;

1974	67th Session "Airline Cardiac Arrest Program" M F O'Rourke, E Donaldson
1995	68th Session "Poster Presentation of Cardiac Arrest Program" M F O'Rourke, E Donaldson
1997	46th Annual Scientific Session of American College of Cardiology "The First Five Years of the Qantas Cardiac Arrest Program" M F O'Rourke, E Donaldson

*** Personally presented**

AWARDS AND DISTINCTIONS:

1960	Preliminary Flight Badge
1973	Flight Medical Officer Badge
1977	Army Flying Badge
1979	Harkness Medal for Service to the Royal Australian Army Medical Corps
1982	Honorary Life Member of the Society of The United States Army Flight Surgeons
1983	Patterson Visiting Lecturer in Aviation Medicine to the New Zealand Branch of The Aviation Medical Society of Australia and New Zealand.
1994	Howard K Edwards Memorial Award "The outstanding practice of Aviation Medicine pertaining to Professional Airline Pilots" (Aerospace Medical Association)
1997	Airline Medical Directors Association Award "For outstanding and innovative contributions to Aviation Medicine"
1998	Doctor of Griffith University
1999	Honorary Life Member Aviation Medical Society of Australia and New Zealand
2000	Medal of the Order of Australia

Dermal	**Respiratory**	**Cardiovascular/circulatory**	**Neurological Psychological**	**Hepatic (Liver)**	**Renal**	**Reproductive**	**Gastro Intestinal**	**Musculo Skeletal**	**Ear Nose Throat**	**Eyes**	**Misc**
Skin Irritations (non-specific)	Asthma	Oedema of extremities (hands and feet)	Anxiety/Stress	Hepatic failure	Renal calculi (stones)	Dysfunctional and or irregular bleeding	Anal haemorrhaging	Back pain	Chemical taste in throat	Burning stinging of eyes	Allergic reactions
Blemish/ Blotchy skin	Bronchitis	Hypertension	Blackouts	Abnormal liver function	Haematuria (blood in urine)	Penile erection failure	Diarrhoea	muscular tiredness	Loss of olfactory sense	Dendritic/ Corneal ulcers of the eye	dehydration
Carbuncles (Boils)	Coughs	Numb extremities	Chemical intoxication/ exposure	Hepatitis B		Loss of libido	Haematemisis (vomiting blood)	Poly arthritis	Loss of taste	Temporary blindness	Mild hypothermia
Haemorrhagic lesions(blood filled blister)	Partially collapsed lung	Chest pains	Claustrophobia	Gilberts Syndrome		Testicular lumps/ tumours	Melaena (gastointestinal bleeding)	Sore joints	Nose bleeds / epistaxis	Blurred / impaired vision	Recurring cold symptoms
Burning / stinging sensation of skin	Poor Lung Capacity	Heart irregularities	Depression	High CK enzymes		Congenital abnormalities (children)	Gastric reflux		Sore ears	Watery eyes	Lethargy
Cold sores	Respiratory problems	Heart murmur	Unsteady gate	High Toxin levels			Gastric complaints		Sore throat	Chronic conjunctivitis	
Dermatitis	Dyspnoea/ Shortness of breath	Angina(chest pains)	Vertigo (dizziness)				Indigestion / heart burn		halitosis		
Eczema	Chronic Cough	Enlarged lymph nodes	Drowsiness				Irritable bowel syndrome		Tinnitus		
Hives		Palpitations	Chronic fatigue				Nausea		Ulcerated gums		
Foot rash			Exhaustion				Vomiting/Dry Retching		sinusitis		

Dermal	Respiratory	Cardiovascular/circulatory	Neurological Psychological	Hepatic (Liver)	Renal	Reproductive	Gastro Intestinal	Musculo Skeletal	Ear Nose Throat	Eyes	Misc
Fungal growth			Tics/eye twitch						Hearing Loss		
Fuel /Chemical burns			Head aches				Abdominal pain		Nasal Irritations		
Alopecia/Hair loss			Head pain				Weight loss				
Weeping scalp			Indecisiveness								
Keratosis Pilaris Infected hair follicles			Insomnia								
Icythyosis(dry skin and scalp)			Irritability								
Psoriasis Scaley/flakey skin)			Migraines								
Dermal cysts			Vagueness / loss of concentration								
Melanoma			Clumsiness / loss of coordination								
Solar keratosis Skin damage/ wrinkles			Low alcohol tolerance								

Dermal	Respiratory	Cardiovascular/circulatory	Neurological Psychological	Hepatic (Liver)	Renal	Reproductive	Gastro Intestinal	Musculo Skeletal	Ear Nose Throat	Eyes	Misc
Skin Lesions/non malignant			Loss of memory / lapses								
Skin infections eruptions (pus)											
			Mood swings								
Skin odour			Paranoia								
Hyper-Hidrosis (excessive sweating)			Psychological problems								
			Reduced learning capacity								
			Tremors								
			Short attention span								
			Short term memory loss								
			Slurred speech								

NUMBERS AND PERCENTAGES OF PERSONS REPORTING HEALTH COMPLAINTS BY CATEGORY

CATEGORIES OF HEALTH COMPLAINTS	NUMBER OF PERSONS WITH COMPLAINTS	PERCENTAGE OF PERSONS
DERMAL	196	39.04%
RESPIRATORY	49	9.76%
CARDIOVASCULAR/ CIRCULATORY	20	3.98%
NEUROLOGICAL/ PSYCHOLOGICAL	237	47.21%
HEPATIC (LIVER)	10	1.99%
RENAL	5	1%
REPRODUCTIVE	5	1%
GASTRO-INTESTINAL	69	13.75%
MUSCULO-SKELETAL	15	2.99%
EAR/ NOSE/ THROAT	39	7.77%
EYES	60	11.99%
MISCELLANEOUS	28	5.58%

The above table is a summary of the most common health complaints that the members reported in their Health Questionnaire (ZZ5 Questionnaire). These complaints have been divided into a number of generic categories and the percentages are based on the whether a member has made a complaint (whether one or more) in a particular category rather then the number of complaints a person may have in any one category.

CLAIMS FOR COMPENSATION

NUMBER	CLAIM MADE
WIT.0018	I recently lodged a claim in respect to the skin problem which I had on my forearms when I was at Reseal/Deseal. I thought I should put the claim in as it seemed that there was a good chance that it was related to my exposure to the chemicals. At this time, no final decision on the claim has been advised to me.
WIT.0090	About 1996 I lodged a claim with the Department of Veterans Affairs for the loss of my sense of smell and taste, but it has not been accepted.
WIT.0212	I confirm that I have made a compensation claim which was rejected and now remains in abeyance pending the receipt of further information.
WIT.0322	I have made an application for compensation to the Department of Veterans Affairs or Comcare. It relates to an accident on the 6th January 1986 in which my foot was broken – an event outside the hanger. The claim was accepted and finalised in 1996
WIT.0405	I lodged a claim for my back injury, which occurred in about 1986, and that claim was accepted. I have not lodged any other claims.
WIT.0304	I have submitted a claim to the Department of Veteran's Affairs as a result of the recommendation made to us to this effect at a briefing we received at the outset of this investigation.
WIT.0015	I have lodged a Commonwealth Compensation Claim. I did this in early 2000. I have not had a response to date. All of the Fuel Tank Repair section guys went down to a conference room, and some guys from MCRS came out and told us what to put in the forms and then collected them and took them with them.
WIT.0120	I have made a claim for compensation.
WIT.0229	I have made a claim for compensation in relation to my shoulder and this was lodged with Comcare in 1998. I sustained this shoulder problem playing rugby union for RAAF in September 1996.
WIT.0105	I have made a claim on Comcare or Veterans' Affairs Department.
WIT.0221	I have put in a Comcare claim. In early 2000 a group of us were taken to a meeting with Comcare representatives and they assisted us in completing our separate claim forms.
WIT.0390	The guys from FTRS were spoken to as a group. In early 2000 we were encouraged to fill in compensation forms if we had had problems. I filled in the forms after this meeting. I have had an acknowledgment of my compensation claim. On my understanding it has been received, but no determination has yet been made in relation to it.
WIT.0061	I am in the process of making an application to the Department of Veterans Affairs for Compensation with respect to the health issues that I have mentioned previously in this statement. The claim for compensation relates to incapacity for future work.
WIT.0343	I have made a claim about three years ago to the Department of Veterans Affairs with respect to my hip and asthma. The claims were rejected. I was informed the condition which has been labelled asthma was hereditary. There is no family history. This condition is not typically asthmatic – it involves a very dry throat and very husky voice that changes and fades away. Since the Board of Inquiry, I have submitted a compensation claim for voice, asthma, fragile skin on forearm, sub carcinogenic lump and hand arthritis. I am waiting to receive a response.
WIT.0095	In terms of DVA and Comcare claims I have one pending for sunspots and my application in relation to the depression has been refused.
WIT.0344	I have made a claim for compensation, and further I have also requested through MCRS the information as to the type of problems/symptoms that were possible at the time which might be related to using the chemicals I came into contact with. As specified, I had an unidentified stomach disorder and a tumour on my right period gland, which has now been removed, and I am concerned that these problems may be related to my previous work.
WIT.0213	I did lodge a Comcare claim but it was rejected on insufficient grounds to associate my complaint with my service
WIT.0236	I have made a Com Super claim and I am also on a Military Superannuation Benefit

	Scheme Pension. I have also made a Department of Veterans' Affairs claim.
WIT.0299	1 had made a claim both to the Department of Defence Comcare (Reference No 94/CQR/22), to the Department of Veteran's Affairs (SM 12611). The latter claim was subsequently transferred to the Veteran's Review Board on Appeal under file Q94/0810. My claims were all rejected. I intend to resubmit the claims. I have also sought legal advice in relation to a civil action regarding my condition. I am currently in receipt of a MSBS Class A Pension. I have obtained part time employment and this is of a voluntary nature and I am paid by donation only. I purposely found work where I was not subject to a timetable and where I could structure my involvement myself around my health. I've generally worked no more than 3 days per week at the most in the past few years.
WIT.0244	I have lodged two Comcare claims as a result of my work in the Defence Force: 1991: Pterigium (skin on eye) which I believe was caused as a result of my work on the flight line; and 1974-1975: A back injury which is resolved - not related to the Deseal/Reseal Program.
WIT.0418	I lodged a claim in regard to my hip injury but this was refused.
WIT.0087	I lodged a claim with Comcare for compensation for a growth but the claim was refused.
WIT.0159	I have DVA claims accepted in relation to a left knee injury, a lumbar injury related to a lumbar puncture during treatment and the claim in relation to Seborrhoeic dermatitis anul section. I am also pursuing a claim in regards to the meningitis.
WIT.0214	In regards to compensation claims I have lodged a Department of Veteran Affairs (DVA) claim in regard to the skin condition as well as skin cancers, a shoulder problem, right elbow, left wrist, hearing (Grade 2), upper back and right knee and right ankle problems. My application to DVA also claims compensation for contracting chronic fatigue, which I believe is as a result of contracting Ross River Fever. I have also placed a claim with MCRS for Ross River Fever.
WIT.0061	I am in the process of making an application to the Department of Veterans Affairs for Compensation with respect to the health issues that I have mentioned previously in this statement. The claim for compensation relates to incapacity for future work.
WIT.0072	I have made previous compensation claims, but these have been rejected because I was not able to establish the nexus between the various ailments and my RAAF service. These claims were made in 1996 and were rejected.
WIT.0080	At this point in time, I have put in a general claim for compensation and am awaiting the outcome of this Board of Inquiry before pursuing my claim further.
WIT.0080	I have made a claim to Department of Veterans Affairs in respect of the melanoma. The claim has been accepted based on exposure to sunlight not chemicals. I have made no claim regarding abnormal liver function at this stage.
WIT.0309	I have made applications for compensation. DVA QSM12815 is my Veteran Affairs number for compensation for left ankle, left knee and left shoulder. These injuries bear no relationships to the Deseal/Reseal Program. TY0183-01 Comcare file relates to my diagnosed agrophobia which first evidenced itself in 1983. TAY0183-03 Comcare file for Alopecia Areata (massive hair loss) which first evidenced itself during the late 1970s. TAY0183-6 Liver Disease first evidenced itself in 1983 when blood tests started. All these claims have been rejected by Comcare. The determinations are attached as Annexure "TGT 3" to this statement.
WIT.0345	In 1991 I lodged a claim for compensation for this skin condition. I do not know my Comcare file number. I recall that no decision was made on the Comcare claim for

	the period 1991 to 1994. In 1994 my compensation claim was rejected. I still suffer from skin sensitivity. I believe the RAAF treated me like "*a bit of waste*". The RAAF chain of command did not take my medical condition seriously and although it was my initial intention to serve for 20 years my service career was cut short when I was bound to an office job. The hierarchy ignored my requests for improved PPE in engine rebuild section and unfairly labelled me a "whinger".
WIT.0068	I have recently (in July 2000) made a claim for compensation to Veterans Affairs. The claim was rejected three weeks later. I am going to consider my position further, after the BOI Report is available. It has been rejected because Veteran Affairs maintain that there is probably no nexus between the work that was performed in the Deseal/Reseal Program and the injury/disability that I suffer.
WIT.0121	I have made a claim for compensation in relation to my breast cancer condition. I have received a claim number. The claim has not yet been determined.
WIT.0098	In 1997 I filed a claim with the Military Compensation and Rehabilitation Service for the Nephropathy which I believe may have been the result of malaria which I contracted during one of my trips to Papua New Guinea in 1987. The File Number was 97/DQR/26. That claim was rejected on the basis that there was no causal link with malaria. I am now concerned that it may be related to work at Deseal/Reseal Section and may accordingly re-lodge my claim.
WIT.0244	I have lodged two Comcare claims as a result of my work in the Defence Force: 1991: Pterigium (skin on eye) which I believe was caused as a result of my work on the flight line; and 1974-1975: A back injury which is resolved - not related to the Deseal/Reseal Program.
WIT.0300/0506	I lodged a claim for compensation relating to my medical conditions with DVA in the early 1990s. The claim was initially rejected, but was subsequently accepted in March 1994 when I was put on a 60% disability pension. This pension was increased to a 100% disability pension in November 1995 and I have been on a full TPI pension since March 1999. My file reference at Comcare Brisbane Section is 94-WQR-58. I have previously made claims for compensation with the Department of Veterans' Affairs under reference number QSN 08706 /001. My claims have been accepted and approved for the following medical conditions: Impotence Psoriasis Depressive Disorder Late Effects of other unspecified Infectious and Parasitic Diseases All claims have been accepted on the basis of chemical exposure during my RAAF Service.
WIT.0079	The date of my motor vehicle accident was 28th September 1984. I had returned to the Base and had an accident and was hospitalised for six months. I lodged some claim forms and after initially being told that they accepted liability, was subsequently told that that was a mistake and that my claim was denied. I have not received any compensation whatsoever in relation to the loss of my left leg above the knee, and I was discharged from the RAAF on completion of my initial engagement period. I think my application for compensation was to Veterans Affairs and to the Department of Defence. I still do not know for sure the cause of the accident. It occurred just outside 12 Squadron after I had returned from Ipswich to get supplies for a toga party. I went to Ipswich about 4.30pm and the accident happened about 5.05pm. Witnesses said it looked like I just laid the bike down as I rode along a straight stretch of road. Laying the bike down is not something I would have done purposely. It was daylight, it was dry and I had not been drinking. It is possible I blacked out.

WIT.0357	I have made current claims for compensation, which have been accepted in respect of hearing loss and orthopaedic problems, but these are in no way connected to the work mentioned in this statement.
WIT.0353	The only claims for compensation I have lodged to date relate to hearing loss and skin cancers. Both claims have been accepted by the Department of Veterans Affairs.
WIT.0360	I have made two compensation claims, one under file Number FRA0165-01. I cannot recall the second claim number. The first relates to the liver and abdominal discomfort and the second relates to asthma.
WIT.0456	In relation to Veterans Affairs Applications, in or about 1982 I made a claim for compensation through the Veterans Affairs Department which was ultimately accepted in March 1983 with eligibility back dated to May 1981. My claim number was CSM04809A. I have subsequently had numerous review of my claim for Disability Support Pension by Veterans Affairs. Most recently, on or about 16 October 1998, a decision was made accepting my claim for psoriatic arthropathy. Further, they decided to continue my Disability Support Pension of 50% of the general rate.

TERMS OF REFERENCE FOR THE DEPARTMENT OF VETERANS AFFAIRS/DEFENCE EPIDEMIOLOGICAL STUDY

This paper outlines the proposed research on the health of individuals involved in the deseal/reseal of the fuel tanks on the Royal Australian Air Force (RAAF) F-111 aircraft.

Background

2. In 1973, Australia received twenty four F-111 C aircraft; later, Australia received some additional F-111 G aircraft from the United States that were surplus to American needs. The fuel tanks within all these aircraft were sealed chemically. With the passage of time, the sealant degenerated. It was necessary to remove the degenerated sealant, and replace it with new sealant.

3. The process of removal of degenerated sealant required that it be first treated chemically, and then removed physically, initially with water jets and with, final removal then being largely by hand-held tools. The individuals responsible for removing the degenerated sealant had to climb into the fuselage fuel tank. The wing tanks did not require entry. Although they wore protective clothing and had breathing apparatus, it has become apparent that individuals were potentially exposed to a variety of chemicals that were used in this process. Further, it is not clear that breathing apparatus was used in the early program.

4. It should be noted that there were three different programs. Although there were some similarities and common themes, each program involved different process. The first of these was in the early 1980’s, the second program was in the late 1980’s, and the final program was from 1996 until present. In addition, there was a program of desealing and resealing the wing fuel tanks. It is believed that the total number involved in all the programs is about eight hundred.

5. Several health concerns have been raised. It was noted that some involved in the programs suffered from neurological and psychological changes. There are anecdotal reports of an increase in incidence of multiple sclerosis. There have also been similar reports of an increase in malignant neoplasms, particularly neoplasms of the bowel.

Description of the Health Study

6. The successful tenderer will, working in conjunction with the Commonwealth Departments of Defence and Veterans’ Affairs, and with members of the Australian Defence Force, undertake a health study of those involved in the deseal/reseal program. The health study will include:

- psychometric testing, aimed at assessing any measurable change in intellectual ability, presence of psychological illness and personality changes in the cohort and an assessment of alcohol use;
- the incidence of malignant disease of the cohort;
- the prevalence of multiple sclerosis of the cohort;
- the mortality experience of the cohort;
- the incidence of major congenital abnormality in the children of the cohort;
- the incidence of malignancy in the children of the cohort; and
- additional health related matters regarding environmental contaminants, occupational health and safety issues and the involvement of other than RAAF personnel in the program.

7. These measures of health will be also assessed in a comparison group of Defence personnel that were not involved in the deseal/reseal program. The Departments of Defence and Veterans' Affairs will assemble this group, with input from the successful tenderer.

8. The successful tenderer will be required to work in conjunction with a formal Board of Inquiry. The successful tenderer will be required to regularly update council assisting the Board of Inquiry, and possibly provide reports to the Board of Inquiry.

9. An independent Scientific Advisory Committee (SAC) will oversight the health study. The tenderer will be required to submit a protocol outlining in precise detail the research strategy. The SAC will be required to approve the protocol submitted by the tenderer and the tenderer must sign-off the final report. The tenderer will be required to provide the SAC with quarterly updates on the progress of the study. At the conclusion of the study, the tenderer will be required to produce a report to the Minister assisting the Minister for Defence and Minister for Veterans' Affairs, the Honourable Bruce Scott, the Chief of the Australian Defence Force, Admiral Chris Barrie, the Chief of Air Force, Air Marshal E J McCormack and the Director General Defence Health Service, Brigadier Wayne Ramsay. This report will require the specific endorsement of all members of the SAC.

10. The tenderer will also be required to seek publication in appropriate peer-reviewed journals of high standing, articles outlining the major findings of the research. It is envisaged that these articles will be co-authored by members of the SAC, and possibly by staff of the Departments of Veterans' Affairs and Defence, and possibly by members of the Australian Defence Force.

11. The tenderer may need to provide advice on methods and practices of occupational health within the deseal/reseal program, and on the applicability of lessons learnt in this program to other occupational settings. The tenderer will also make recommendations on the need for and nature of additional future research, although these recommendations should not be designed with an implied or explicit expectation that the tenderer will be asked to undertake this research.

12. The tenderer will also be required to regularly meet with and give an account of the progress of the research to the members of deseal-reseal cohort, or possibly a representative committee of the cohort.

13. The tenderer may recommend additional research directions and may be required to assist the Commonwealth in providing advice to appropriate authorities in the United States on the results of the study, and the relevance to populations in the United States of the Australian findings.

14. There is a variety of reasons why this study will need to be compiled in a timely fashion, however, any time-frames imposed will have regard to controls in areas such as data specifications, forms and other relevant information provided by the Commonwealth to the tenderer. To this end, the successful tenderer will be required to provide the Commonwealth with a detailed plan outlining the proposed study. The plan should include a series of measurable milestones against which demonstrable progress can be measured. The contract that the Commonwealth will draw up with the successful tenderer will make payment dependent on successful achievement of these milestones.

15. It will also be necessary for the tenderer to provide the Department of Veterans' Affairs, the Scientific Advisory Committee and the Board of Inquiry with a series of progress reports. Each progress report will include an outline of the health findings that the tenderer has discovered within the cohort. The highest priority is an estimation of cancer risk. If any particular malignancy is shown to have an elevated risk, the tenderer should provide a detailed discussion of the cost, benefit and risk associated with a prevention, screening or

early treatment program for that particular cancer. The Commonwealth requires the cancer risk section of the health study to be completed within a few months of the signing of the contract with the successful tenderer.

16. A screening process to determine other illnesses or diseases that should receive priority attention during the course of the study will be the subject of consultation between the SAC and the tenderer.

Features of the Successful Tenderer

17. The successful tender will have:

- a proven ability to plan and execute epidemiological studies in a timely fashion, and a demonstrated ability to set down plans to implement such epidemiological studies. Such plans should contain detailed time-frames for the implementation of the proposed study. The tenderer will need to have a demonstrated ability to adhere to such time-tables;

- strong academic qualifications, with members of the successful tender having an appropriate track record within such fields as epidemiology, occupational health or neurological epidemiology;

- an ability to implement a standardised health examination throughout South East Queensland, and possibly Australia;

- well developed marketing and communication skills.

18. It is envisaged that the successful tenderer may well need to draw in skills and expertise of individuals within several organisations.

19. The Australian Institute of Health and Welfare (AIHW) is responsible for maintaining the National Death Index, the Australian Clearing House for Cancer and the National Register of Birth Defects. As it will be necessary for the successful tenderer to make use of these registries, the Commonwealth will liaise with AIHW to ensure an appropriate level of access to the AIHW's facilities and services is available to the successful tenderer.

The Tender Process

20. Acting as a agent for the Commonwealth, the Department of Veterans' Affairs will request interested parties to submit an Expression of Interest. The groups or individuals who have submitted an Expression of Interest will be expected to provide a statement, outlining what they perceive to be the strengths of their proposed tender. Selected parties who have submitted an Expression of Interest will be invited to attend a one-day briefing in Brisbane. The seminar will consist of two parts. In the first part, general information will be provided to all those who have expressed interest in undertaking the study. This will include background on the deseal/reseal program and a presentation from the Australian Institute of Health and Welfare, demonstrating to interested tenderers how they will make the registries available to the successful tenderer. During the second part, representatives of the Commonwealth will provide feedback to those who have expressed interest in undertaking the study on an individual basis. During this interview, the Commonwealth will provide information on what it is perceived is the weaknesses and strengths of the proposals concerned.

21. The Commonwealth reserves the right to request that some or all tenderers should consider forming joint tenders.

22. Following an assessment of the strengths and weaknesses of the various tenders, the Commonwealth will invite some or all of those who have expressed interest to submit a tender. Only those who have expressed interest will be eligible to be invited to tender for the

study. The assessment of the merit of those who have expressed interest in undertaking the study will be made by the Commonwealth, with advice from the independent Scientific Advisory Committee (SAC).

23. Those who have been invited to tender will be required to submit a tender in writing by close of business on a particular day. Following this, each invited tenderer will be asked to supplement their written tender by an oral presentation.

CROSS REFERENCE – TERMS OF REFERENCE vs SECTIONS OF THE INQUIRY REPORT

Terms of Reference	Volume 2 Part 1	Entrenching Safety in the RAAF – A review of systemic issues, and the Recommendations with a view to preventing recurrence
1.a.	Chapter 3	The First Deseal/Reseal Program 1977-1982
1.b.	Chapter 4	The Second Deseal/Reseal Program
1.c.	Chapter 5	The Spray Seal Program 1996-1999
1.d.	Chapter 6	The Wings Deseal/Reseal Program 1985-1992
2	Annex C	List of Witnesses by Category
3.a.(1)	Annex A	The Chemicals, Their Toxicity and their Application
	Annex A	Chemicals Used on Each Program
	Annex B	Chemicals Data
3.a (2)	Annex A	The Chemicals, their Toxicity and their Application
	Annex A	Chemicals Used on Each Program
	Annex C	Danek Report
	Annex D	List of Material Safety Data Sheets
3.a. (3)	Chapter 8	Personnel Protective Equipment and Instructions for Its Use
	Annex A	PPE Lists
3.a. (4)	Chapter 9	Work Instructions, Methods and Practices
	Annex A	Hierarchy of Technical Regulations and Instructions
3.a. (5)	Chapter 9	Work Instructions, Methods and Practices
3.a. (6)	Chapter 9	Work Instructions, Methods and Practices
3.a. (7)	Chapter 10	Occupational Health and Safety
	Annex A	Hierarchy of OH&S Regulations and Instructions
	Chapter 2	Extant RAAF Safety Management System
	Volume 2 Part 2	**Safety Management Systems**
	Chapter 1	Safety Management Regimes
	Chapter 2	Extant RAAF Safety Management System
	Chapter 3	Comparison of RAAF Corporate Safety Management Framework with Other Safety Management Frameworks
	Chapter 4	Comparison of RAAF Workshop Safety Management System with Other Safety Management Systems
3.a. (8)	**Volume 2 Part 1**	
	Chapter 8	Personnel Protective Equipment and Instructions for Its Use
	Chapter 9	Work Instructions, Methods and Practices
	Chapter 10	Occupational Health and Safety
	Chapter 11	Compliance with Instructions
3.a. (9)	**Volume 2 Part 1** Chapter 10 Annex B	Commonwealth Compensation Legislation
3.a. (10)	Chapter 11	Compliance with Instructions
3.a. (11)	Chapter 13	Medical
	Annex C	Danek Report
3.a. (12)	**Volume 1** Preface	Overview
	Chapter 1	Introduction
	Chapter 2	The Failure of the Air Force Medical Service
	Chapter 3	The Limitations of the Chain of Command
	Chapter 4	The Impact of Production Pressures
	Chapter 5	Incident and Hazard Reporting

	Chapter 6	The Problem of Responsibility for Health and Safety
	Chapter 7	Taking the Hierarchy of Controls Seriously
	Chapter 8	Audit/Review of the Workplace
	Chapter 9	The Command and Discipline System
	Chapter 10	Organisational Learning
	Chapter 11	Summary of Main Findings
	Volume 1 **Part 2** Appendix 1	Appointment and Conduct of the Inquiry
	Appendix 2	Appointment Instrument and Terms of Reference
	Appendix 3	List of Board Recommendations
	Appendix 4	Comment on Matters that might Warrant Further Inquiry
	Appendix 5	Health Effects
	Appendix 6	List of Witnesses who Appeared Before the Board
	Appendix 7	The Media Response and Press Coverage
	Appendix 8	'The Ambulance Down in the Valley'
3.a. (13)	Appendix 4	Comment on Matters that might Warrant Further Inquiry
3.b. (1)	Appendix 6	List of Witnesses who Appeared Before the Board
	Volume 2 Chapter 2	Background - The Deseal/Reseal Programs in Perspective
	Chapter 12	Personnel Who May Have Been Affected
	Annex A	List of Personnel Who May Have Been Exposed to Hazardous Chemicals and Their Duties
	Annex A	List of Personnel Who May Have Been Exposed to Hazardous Chemicals and Their Duties
	Annex B	Photographs of Deseal/Reseal Section Personnel 1980-1992
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GLOSSARY

A

A1	The first rear fuel tank F-111
A2	The second rear fuel tank F-111
Accelerator	The curing agent used in multi part-curing type Sealants
Acetate	Salt or ester of acetic acid
Acetone	Colourless, volatile liquid, ketone, valuable as solvent of organic compounds
Acidic	Pertaining to the nature of acid
Acute Exposure	One dose or multiple doses of short duration within a 24 hour period.
Acute Toxicity	Any poisonous effect produced within a short period of time following an exposure, usually 24 to 96 hours
Adhesion Promoter	Material applied to a surface to enhance curing type sealant adhesion
Adhesive Sealing	Application of structural adhesive to surfaces to form a primary seal
Aerodynamic	Study of interaction between air and solid bodies moving through it
Aerosmoothing	Aerodynamic smoothing referred to in the wings program involving to smooth sealant PR1750 flush with the surface
Aerosol Cleaners	System of colloidal particles dispersed in gas (for example, fog or smoke) (container of) substance packed under pressure with device for releasing it as fine spray
Aerowash	detergent
Alodine	Conversion coating MIL-C-5541
AM2	Mineral Oil MIL-L-6081C
Ansell	Manufacturer of a nitrile type glove
Australian Air Publication (AAP)	Instructions promulgating technical processes, procedures and materials
AVTUR	Aviation turbine fuel (JP4, JP8)

B

Barrier	Epoxy barrier between tank surface and sealant
Bowel	Intestine – parts of the alimentary canal below the stomach
Buddy/babysitter	Person placed to monitor another working within a confined space in case of an emergency
Butyl gloves	gloves manufactured from butyl rubber

C

Carcinogenic	Any substance which tends to produce a cancer in a body
CAS Number	A unique numerical identifier assigned to each individual chemical
Caulking gun	Device employed to extrude sealant from a tube
Cellosolve	Cleaner/solvent MIL-C-38736
Claustrophobia	Morbid dread of confined spaces
Confined Space	A tank, vessel, open topped tank, or any other enclosed space that is not designed for continuous occupation. A person is considered to be inside a confined space if their head and shoulders are inside the space
Controlled Document	A document that is subject to a management process that ensures content integrity
Corrosion Preventive Compound	Material applied to surface to provide corrosion resistance
Cure stabiliser	Harden (concrete or rubber); vulcanize (rubber)

D

Defatting	Remove fat(s) from
Deoxidene 624	Oxide remover manufactured by Henkel
Depuddle	Removal of fuel or other liquid puddles from fuel tanks
Deseal	Removal of sealant from integral tank surface
Desealant	Chemical used to remove or loosen cured sealant
Dow Corning	Manufacturer (of Q4-2817 fluorosilicone sealant)
Drager Unit	Air supply and respirator

E

EC2216	Original epoxy barrier produced by 3M Company
EC3580 B/A	A structural adhesive (Epoxy barrier) manufactured by 3M Company
EC5106	Original polyester sealant manufactured by 3M Company
EC5146	Modified polyester sealant manufactured by 3M Company superseding EC5106
EC5123	Original sealant manufactured by 3M Company MIL-S-83430
ED500	Cleaner/solvent manufactured by the Eldorado Chemical Company MIL-C-25769G
EE505	Maintenance call out form
EE508	Form used to record tasks that were carried out during the Deseal/Reseal Program, which were not on the DRS worksheets
Emphysema	Abnormal distension of an organ or a part of the body with air or other gas, especially pulmonary emphysema which causes severe restriction of respiratory function
Entry Permit	Approval to enter a confined space
Epoxy Barrier	Epoxy adhesives EC2216 and EC3580 employed in the fuel tank to protect new sealant from hydrolysed polyester
Equipment	Electrical equipment which can be used in potentially explosive atmospheres. Any explosion occurring with the equipment is confined
Explosimeters	Intrinsically Safe Combustible Gas Meters. Specialised equipment, usually battery powered, that by design is unable to produce sufficient sparking to ignite a flammable atmosphere even if the instrument is faulty
Explosion Proof Equipment	This is an acceptable safety protection method whereby electrical equipment can be used in potentially explosive atmospheres: any explosion occurring with the equipment is confined in such a way as to prevent the explosion escaping
Explosive Atmosphere	When the vapour concentration level of a flammable liquid vapour has risen to above its LEL
Explosive Meter	Intrinsically Safe Combustible Gas Meters. Specialised equipment, usually battery powered, that by design is unable to produce sufficient sparking to ignite a flammable atmosphere even if the instrument is faulty
Exposure	The amount of physical or chemical agent that reaches a target or receptor

F

F1	The first forward fuel tank
F2	The second forward fuel tank
Faying Surface Seal	A seal between mating surfaces to prevent fuel from travelling along or through the surfaces

Fire Safe	The condition at normal atmosphere where the vapour concentration of a chemical is at or below 10% of the LEL as determined by the use of a combustible gas meter (explosive meter)
Flash Point	The lowest temperature of a combustible material at which, under specified conditions, the tested material gives off sufficient vapour to form an explosive gas/air mixture
Fluorosilicone – Q4	A fluorosilicone sealant manufactured by Dow Corning used in the Wings program
FMS 1023	Fibreglass
FMS 1043	Fibreglass bond

G

Gamulin	General purpose detergent
Goop	Colloquial term for Sealant

H

Hazard	The potential for an adverse event to occur
Hazard Quotient	An indicator of health hazard obtained by dividing the average daily dose by the Reference Dose (RfD)
HAZCHEM Sheets	Hazardous Chemical Sheets
Health Safe	The condition at normal atmosphere where the vapour concentration of a chemical is at or below 3% of the LEL as determined by the use of a combustible gas meter
Hiatus Hernia	Herniation of a part of the stomach through the oesophageal hiatus, often causing heartburn
Hydrolasing unit	High-pressure water pick for removing old sealant from tank surfaces
Hydroscopic	Absorbing or attracting moisture

I

Injection Seal	A seal accomplished by injecting sealant into channels and other voids in the fuel tank boundaries
Insomnia	Inability to sleep – especially when chronic
Integrated Fuel Tank	Cavity within the aircraft structure designed to hold fuel. Effective sealing is achieved by the application of sealant between mating structure components, eg skins, bulkheads etc
Isocyanate	A category of chemicals contained in some chemicals

J

Jetclean B	General purpose detergent

K

Ketone	One of a class of organic compounds containing the group CO
Komet Vapua D	Wet blasting process

L

Leak Path	The path leaking fuel follows from leak source to the leak exit point
LEL	Lower Explosive Limit. The concentration of flammable gas or vapour in air above which an explosive gas atmosphere will be formed

Logistics Engineering Art of moving, lodging, and supplying troops and equipment combined with the application of science for the control and use of power especially by means of machines

M

MEK Methyl-Ethyl-Ketone – used as a cleaning solvent
MIL-P-23377 Military specification for a Primer
MIL-R-81294 Military specification for a Paint remover
Mils-Spec Usual reference to Mil-C-38736 solvent cleaner. Contains 20% MEK
MMS 425 Primer employed as an adhesion promoter for PR2911

N

Neoprene rubber Synthetic rubber-like polymer
Nitrile gloves Gloves used in all programs

O

OMEGA MRD computer database

P

Polysulphide Type of sealant
PR148 An adhesion promoter manufactured by Product Research Company
PR1560 Fuel tank paint manufactured by Product Research Company
PR1750 Polysulphide sealant manufactured by Product Research Company MIL-S-83430
PR2911 Sealant manufactured by Product Research Company
Purge Removal of traces of fuel, solvents etc to safe vapour levels

Q

Q4 Q4-2817 Fluorosilicone sealant manufactured by Dow Corning
QPL Qualified Products List. A list of approved manufactures for chemicals meeting a particular specification.

R

Rag hangar Canvas hangar where chemical desealing took place on the first DRS. Located adjacent to the engine run-up facility at the southern end of the base
Reference Concentration (RfC) An estimate of a continuous inhalation exposure that is likely to be without an appreciable risk of deleterious effects during a lifetime
Reference Dose (RfD) An estimate of a skin absorption dose that is likely to be without an appreciable risk of deleterious effects
Respirator Either full fresh air supply; or independent with fitted canisters depending on hazard
Reverted sealant Sealant which has lost its chemical specification and is no longer an effective sealing agent
Risk (human health) The probability of injury, disease or death from exposure to a chemical agent or a mixture of chemicals
Rivet Rows Nail or bolt for holding together metal plates etc its headless end being beaten out or pressed down after passing through two holes;

	clench (bolt etc) join or fasten with rivets (together, down) fix, make immovable

S

Sabre Unit	A piece of PPE
Sarnex Suits	A piece of PPE
Scotchbrite® pads	Commercially available cleaning pad
Sealant, curing type A	Multiple part sealant which changes after mixing from a soft state to a rubber-like tack-free state
Seed blast	Second phase of removing old sealant from wing tanks. Walnut shell medium
Simmads & Bristow P/L	Chemists - provided report
Sodium Hypochlorite	Oxidizing chemical. Solution used to wash away SR-51 and SR51 spillage
Spirograph	A machine that prints a graph showing patient's lung capacity
Strontium Chromate	Inorganic compound contained in some of the product formulations used in deseal/reseal
SR51	Desealing fluid manufactured by Eldorado Chemical Company. Contains Thiophenol

T

T4460	Cleaner/Solvent manufactured by Turco MIL-C-38736; also known as MILSPEC, F-111 cleaner
Tack-Free	State of cure of sealant when it is dry to the touch
TCTO's	Time Compliant Technical Orders
Tec Blocks	Foam blocks designed to absorb chemicals
Tech Orders	USAF technical instructions, often used as service material for RAAF instructions
TEK-300	Portable air conditioning units (Hockhansen units)
Tent City	Portable shelter of canvas cloth etc. supported by pole[s] and stretched by cords secured to pegs driven into the ground
Thiophenol	Chemical contained in SR51
Toluene	A chemical solvent contained in deseal/reseal formulations
Toxicity	The inherent potential or capacity of a substance to cause adverse effects in a living organism
Toxic Vapour	Toxic air contaminants which are chemical gases or vapours generated to near or above their TLV
Toxicology	The study of harmful interactions between chemicals and biological systems
Trichloroethylene	Cleaning agent
TT-M-261	MEK cleaner/solvent
Turco	Common term for cleaner/solvent product manufactured by Turco and meeting MIL-C-38736. Also known as Mil-Spec, F-111 cleaner

U

UCWS	Under Carriage Work Shop
UEL	Upper Explosive Limit. The concentration of flammable gas or vapour in air below which an explosive gas atmosphere will be formed

V

Vagus Nerve	Either of two cranial nerves extending through neck into thorax and the upper part of the abdomen – a pneumogastric nerve
Validate	The process of reviewing and testing a proposed technical process or procedure
Ventilation	Ventilated forced airflow to reduce vapour concentration levels
Verify	The application of a technical process or procedure to ensure practicability and efficiency
Viton gloves	Recommended for use with Mil-Spec/MEK

W

Walnut seed blasting	High pressure abrasive blasting process using crushed walnut shell for removing sealant
Wash rack	US facility for maintenance including deseal/reseal
Worksheet	Guide for scheduling a work package, for example, DRS. Worksheets require progressive work certification

X

XA3517	An epoxy barrier manufactured by 3M Company
XA3598	An epoxy barrier manufactured by 3M Company

Y

Z

Z1400	Cleaner/solvent

MISCELLANEOUS

020-707	Solvent reducer produced by Desoto
823-707	Fuel tank paint manufactured by Desoto MIL-C-27725
910-702.1	Paint activator manufactured by Desoto

LIST OF ABBREVIATIONS

A

AAP	Australian Air Publications
ACA	Arduous Conditions Allowance
ACAIST	Air Commander Australia
ACGIH	American Conference of Government and Industrial Hygienists
ACPERS-AF	Assistant Chief Personnel – Air Force
AD	Aircraft Depot
ADF	Australian Defence Force
ADFP	Australian Defence Force Publications
A/DGLOGOPS-LC	Acting/Director-General Logistics Operations – Logistics Command
AEENG6A	Aircraft Equipment Engineering 6A
AFB	Air Force Base
AFFITTs	Airframe Fitters
AFRR	Air Force Resource Requirements
AHQ	Air Headquarters
AIRENG	Aircraft Engineering
AIRENG 4C1	Aircraft Engineering 4C1
AIRENGG4/LC	Aircraft Engineering 4/ Logistics Command
AHLR	Aimstray Health Laboratory Report (Spray Seal Trial)
AHQ (SHO)	Air Headquarters (Senior Health Officer)
AHQ (SOENVH)	Air Headquarters (Staff Officer Environmental Health)
ANSI	American National Standards Institute
AOCSC	Air Officer Commanding Support Command
AS	Australian Standard
ASSAMB	Administrative Support Squadron Amberley
ASSAMB (SMO) (ENVHO)	Administrative Support Squadron Amberley (Senior Medical Officer) (Environmental Health Officer)
ASRP	Assistant Secretary Resource Planning or Aircraft Structural Repair Program
AVM	Air-Vice Marshall
AVMSQN	Avionics Maintenance Squadron
AWA	Amalgamated Wireless Australia
AWASCO	Amalgamated Wireless Australia Serco

B

BFQC	Base Fuel Quality Control Officer
BGSO	Base Ground Safety Officer
BLI	Bench Level Instructions
BMF	Base Medical Flight
BMF DR	*Base Medical Flight Doctor*
BOI	Board of Inquiry – F-111 Deseal/Reseal and Spray Sealing Programs
BSWAMB	Base Support Wing Amberley

C

CA	Chief of Army
CA Team	Counsel Assisting Team
CAF	Chief of Air Force
CAMM	Computer Aided Maintenance Management
CAR's	Corrective Action Requests
CDF	Chief of Defence Force

CDRL	Contract Data Requirement List Contract Deliverable Requirements List
CDRSRG	Commander Strike Reconnaissance Group
CENGR	Chief Engineer
CF	Casual Factor to exposure
CFU	Carry Forward Unserviceability
CFUs	Carried Forward Unservicabilities
CHYGO	Command Hygiene Officer
CMI	Contractor Maintenance Instructions
CMP	Contaminant Monitoring Program
CMTC	Crew Module Time Changes
CN	Chief of Navy
C of A	Certificate of Airworthiness
CO	Commanding Officer
COAMSQN	Commanding Officer Aircraft Maintenance Squadron
COMTRG-AF	Commander Training – Air Force
CPC	Chemical Protective Clothing
CPLT	Cold Proof Load Test
CSP	Commercial Support Program

D

2nd DR/RS	2nd Deseal/Reseal program conducted by Hawker de Havilland Australia
DA	Design Authority
DAA	Design Approval Authority
DAAR	Design Approval Authority Representative
DAC	Design Authorised Contractor
DAFMED	Directorate Air Force Medicine
DAR	Design Approval Record
DCAS	Deputy Chief of the Air Staff
DDOHS	Director Defence Occupation Health & Safety
DEFAIR	Department of Defence, Air Directorate
DEFAIR PERS	Department of Defence (Air Force) Personnel
DGAFHS	Director-General Air Force Health Services
DGAW-AF	Director General – Air Force
DGOR	Director-General Operational Requirements
DGPS-AF	Director-General Personnel Services – Air Force
DGRM	Director-General Resource Management
DGTA	Director General Technical Airworthiness
DGTP-AF	Director-General Technical Plans - Air Force
DI	Defence Instructions
D(I)R	Defence (Inquiry) Regulations
DLM	Depot Level Maintenance
DM	Deeper Maintenance
DMA	Disposals and Marketing Agency
DMO	Defence Materiel Organisation
DOC	Department of Construction
DOHSMAN	Defence Occupational Health and Safety Manual
DR Programs	Deseal/Reseal Programs as defined in the Terms of Reference
DRR-AF	Director Resource Requirements – Air Force
DR	Deseal/Reseal
DSMA	Defence Safety Management Agency
DST(AF)	Director Safety Management (Air Force)
DSML	Director Safety Management Land
DS/RS	Deseal/Reseal
DSTO	Defence Service and Technology Organisation

DVA	Department of Veteran's Affairs

E

EA	Engineering Approval
ECP	Engineering Change Proposal
ECMF	Engine Component Maintenance Flight
EHG	Environmental Health Group
EHS	Environmental Health Section
EHSURV	Environmental Health Surveyor
ELECFITTs	Electrical Fitters
EMOHS	Environmental Management Occupational Health & Safety
ENVH	Environmental Health Flight
ENVHO	Environmental Health Officer
EPA	Environmental Protection Agency

F

FDB	Functional Degree Brief
FM 3AD	From No 3 Aircraft Depot
FMS	Foreign Military Sales
FOD	Foreign Objects Damage
FSD	Foreign Source Data
FSII	Fuel System Icing Inhibitor
FTIT	Fuel Tank Investigation Team
FTRS	Fuel Tank Repair Section
FTRT	Fuel Tank Repair Team

G

GD/FWD	General dynamics/fort worth division
GEMF	General Equipment Maintenance Flight
GSE	Ground Support Equipment
GSI	Ground safety instruction

H

HdH(A)	Hawker de Havilland (Australia)
HDPE	Head Defence Personnel Executive
H/EPG	Head Elastomers and Plastics Group
HMDI	
Hockhansen Units	GSE used to pump cool air into confined spaces
HQLC	Headquarters Logistics Command
HQOC	Headquarters Operational Command
HQOC (BMO)	Headquarters Operational Command (Base Medical Officer)
HQSC	Headquarters Support Command
HQSC AEENG6	Headquarters Support Command Aircraft Equipment Engineering 6
HQSC-ENG	Headquarters Support Command - Engineering
HQSCLOENG	Headquarters Support Command Logistics Engineering
HQSCLOGSPT	Headquarters Support Command Logistics Support
HQSC SG7	Headquarters Support Command Support Group 7
HQSC (SOCM)	Headquarters Support Command (Staff Officer Capability Management)
HQSC SORO	Headquarters Support Command Logistics Staff Officer Repair and Overhaul

HQTC(PMO)	Headquarters Training Command (Principal Medical Officer)

I

IAM	Interim Amendment
ICP	Inductively Coupled Plasma
IF	Influencing Factor to exposure
ILM	Intermediate Level Maintenance
IO	Investigating Officer
IOI	Investigating Officer's Investigation

J

K

L

LEL	Lower Explosive Limit. The concentration of flammable gas or vapour in air above which an explosive gas atmosphere will be formed
LOA	Letter of Agreement
LOAS	List of Authorised Spares
LOEL	Lowest Observable Effect Level
LOT	Life of Type

M

MCA	*Military Compensation Act* 1994 (Cth)
MCRS	Military Compensation and Rehabilitation Service
MCS	Maintenance Control Section
MEK	Methyl-Ethyl-Ketone – used as a cleaning solvent
MRD	Maintenance Requirement Determination
MRL	Materials Research Laboratory
MSDS	Material Safety Data Sheet

N

NCO	Non-Commissioned Officer
NDI	Non-Destructive Inspection
NDITECHs	Non-Destructive Inspection Technicans responsible for sealant quality control and panel inspection
NH&MRC	National Health and Medical Research Council
NOHSC	National Occupational Health and Safety Commission

O

OC	Officer Commanding
OCBSW	Officer Commanding Base Support Wing
OEM	Original Equipment Manufacturer
OH&S	Occupational Health and Safety
OHGS	Occupational Health & Ground Safety
OHSMAN	Occupational Health & Safety Manual

OHSO	Occupational Health and Safety Officer
OICAMF	Officer in Charge Aircraft Maintenance Flight
OICAMF 3AD	Officer in Charge Aircraft Maintenance Flight No 3 Aircraft Depot
OICAMSQN	Officer in Charge Aircraft Maintenance Squadron
OJT	On the job training

P

PIRR	Publication Improvement Report & Reply Forms
PMO	Principal Medical Officer
PPE	Personal Protective Equipment
PPM	Parts Per Million
PRC	Products Research and Chemical Corporation
PSETA	Project, Systems Engineering and Technical Assistance

Q

QPL	Qualified Products List. A list of approved manufactures for chemicals meeting a particular specification.

R

RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RANR	Royal Australian Navy Reserve
RESENG	Resident Engineer
RESENG HDH	Resident Engineer Hawker de Havilland
RFT	Request For Tender
RN	Royal Navy
ROE	Rate of Effort
RSDS	Reseal/Deseal

S

SCA(AF)	Support Command Australia (Air Force)
SCAI DGTA	Support Command Australia
SCBA	Self Contained Breathing Apparatus
SELMU	Support Equipment Logistics Management Unit
SFACO	Senior Facilities Officer
SG	Support Group
SI	Unit Standing Instructions
SIMTARS	Safety in Mines - Training and Research Station
SLENGO	Senior Logistics Engineer Officer
SLSPTO	Senior Logistics Support Officer
SM-ALC	Sacramento Air Logististics Centre (USAF)
SMO	Senior Medical Officer
SMS	Safety Management System
SOAIRENG	Staff Officer Aircraft Engineering
SOP	Standard Operating Procedure
SOR	Statement of Requirement
SORO	Staff Officer Repair and Overhaul
SOSPTB	Staff Officer Support B
SRC Act	*Safety, Rehabilitation & Compensation Act* 1988 (Cth)
SRG	Strike Reconnaissance Group
SRLM SQN	Strike Reconnaissance Logistics Management Squadron
SSE	Ground support equipment

STEL	Short Term Exposure Limit
STI	Special Technical Instruction
STRF	Structural and Tank Repair Flight
SURFINs	Surface finishers

T

TLO	Technical Liaison Officer
TLV	Threshold Limit Value. The airborne concentration of a contaminant that is considered to be the level to which workers may be repeatedly exposed (40 hours per week) without experiencing adverse health effect.
TMP	Technical Maintenance Plan
TMS	Time to Make Serviceable
TO	Technical Order
TOR	Terms of Reference
TWA	Time Weighted Average

U

UCWS	Under Carriage Work Shop
UEL	Upper Explosive Limit. The concentration of flammable gas or vapour in air below which an explosive gas atmosphere will be formed
UMO	Unit Maintenance Orders
USAF	United States Air Force
USSO	Unit Security Safety Officer

V

VEA	*Veterans' Entitlements Act* (Cth)

W

WCTB	Wing Carry Through Box
WG	Wing
WMO	Wing Maintenance Order
WSSF	Weapons System Support Facility

X

Y

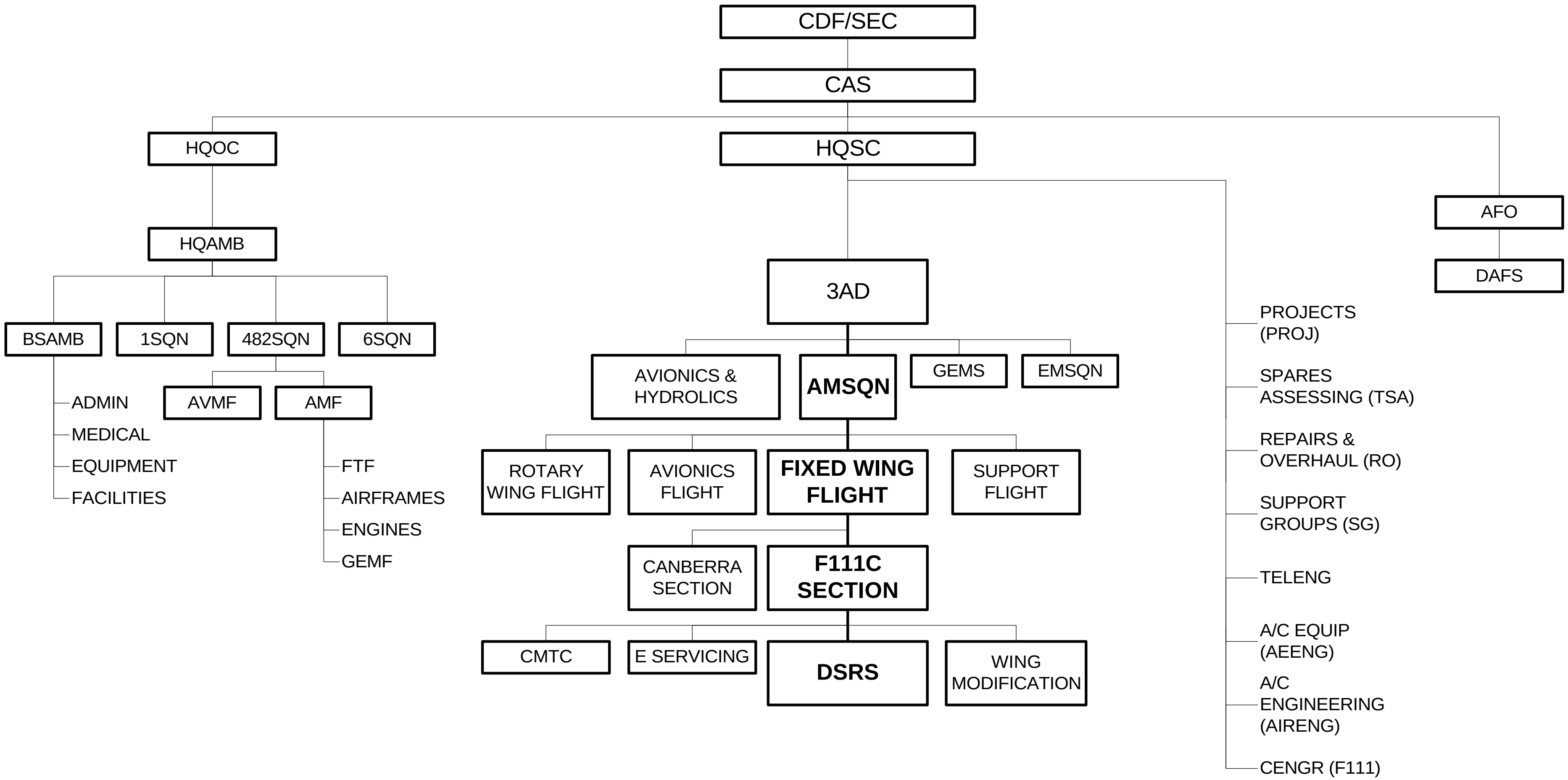
Z

MISCELLANEOUS

2AD	No 2 Aircraft Depot
3AD	No 3 Aircraft Depot
3AD (ASTFITTS)	No 3 Aircraft Depot (Aircraft Structural Fitters)
482SQN	No 482 Squadron Amberley
501 WG	501 Wing

F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE
1976-1978



The CO AMSSQN held the responsibility and secondary appointment of DEPENG/3AD.

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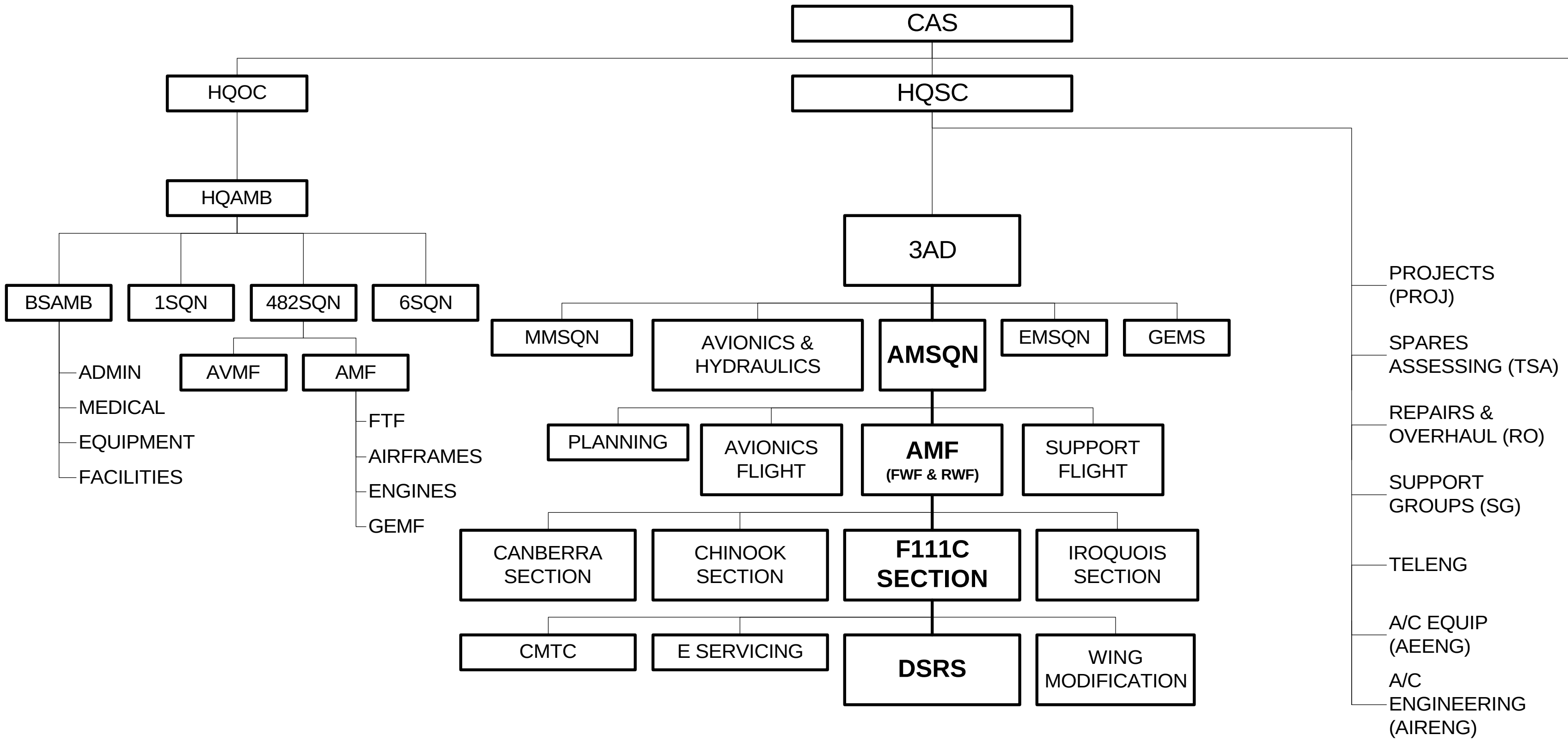
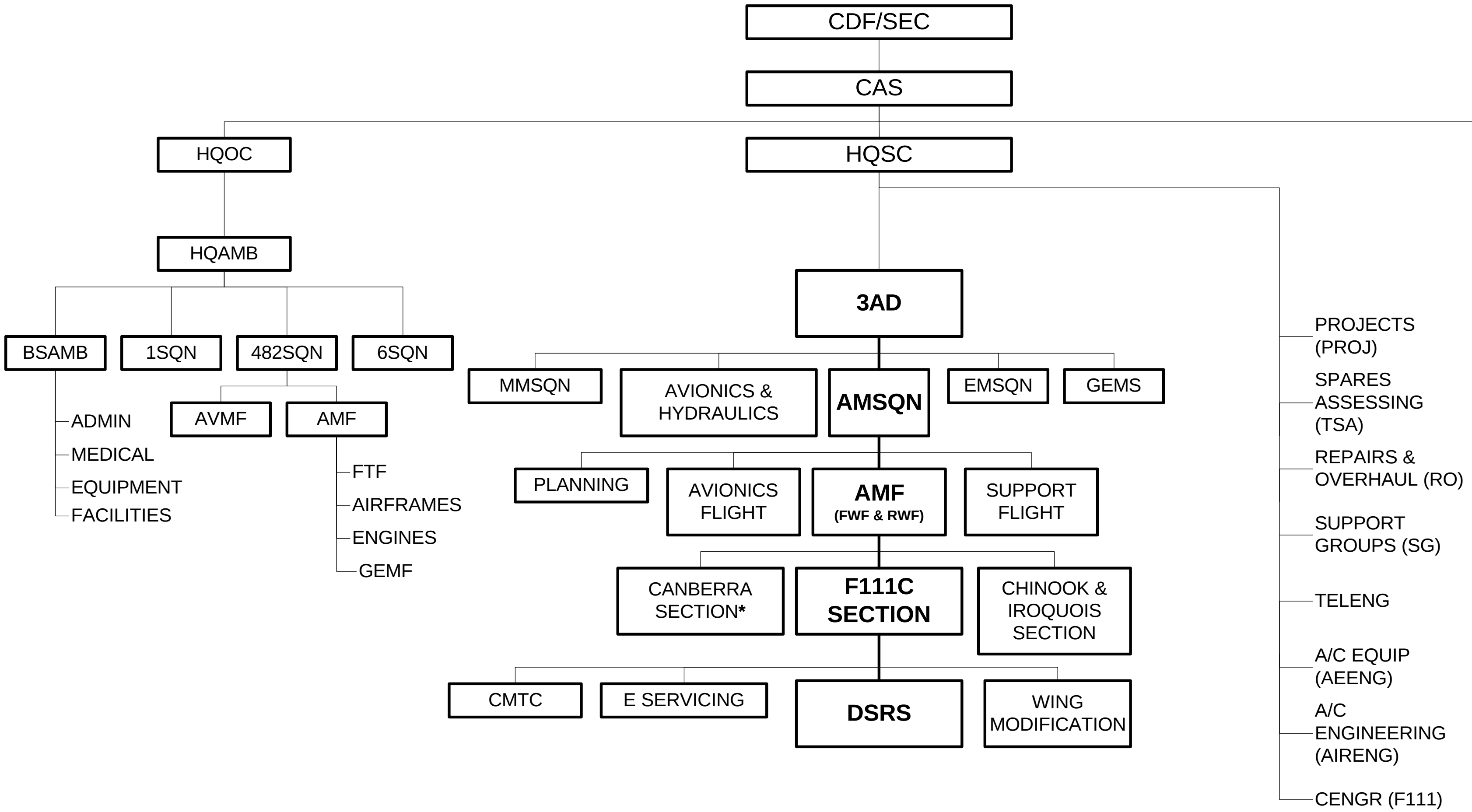
RAAF ORGANISATIONAL STRUCTURE 1979



The evidence conflicts as to wether the combined FWF & RWF was designated AMF or ASF.
The CO AMSSQN held the responsibility and secondary appointment of DEPENG/3AD.

F-111 Deseal/Reseal Board of Inquiry

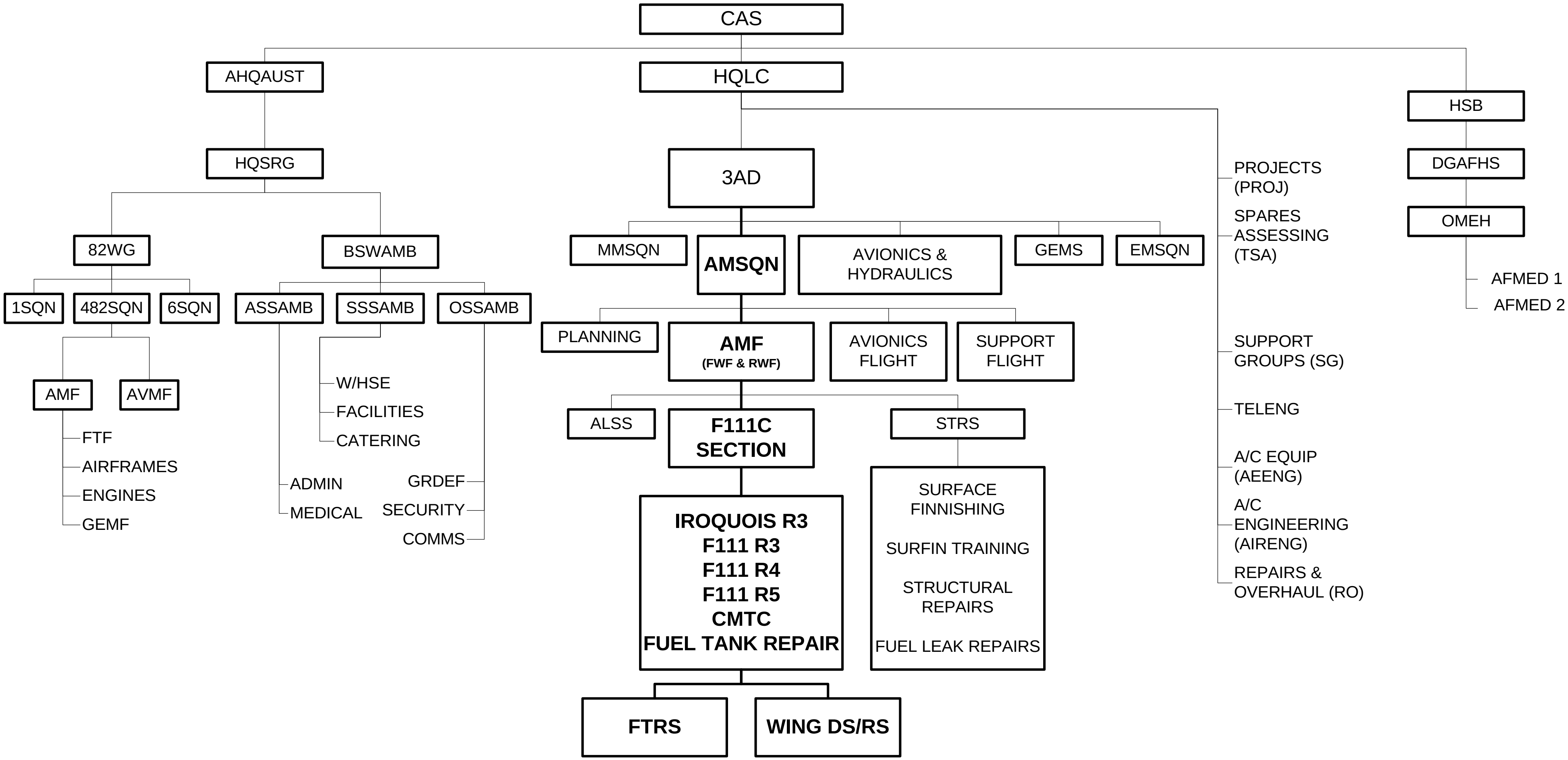
RAAF ORGANISATIONAL STRUCTURE
1980-1987



*****Note: CANBERRA SECTION disbanded in 1983.
The CO AMSSQN held the responsibility and secondary appointment of DEPENG/3AD until 1984 when the position was disolved.

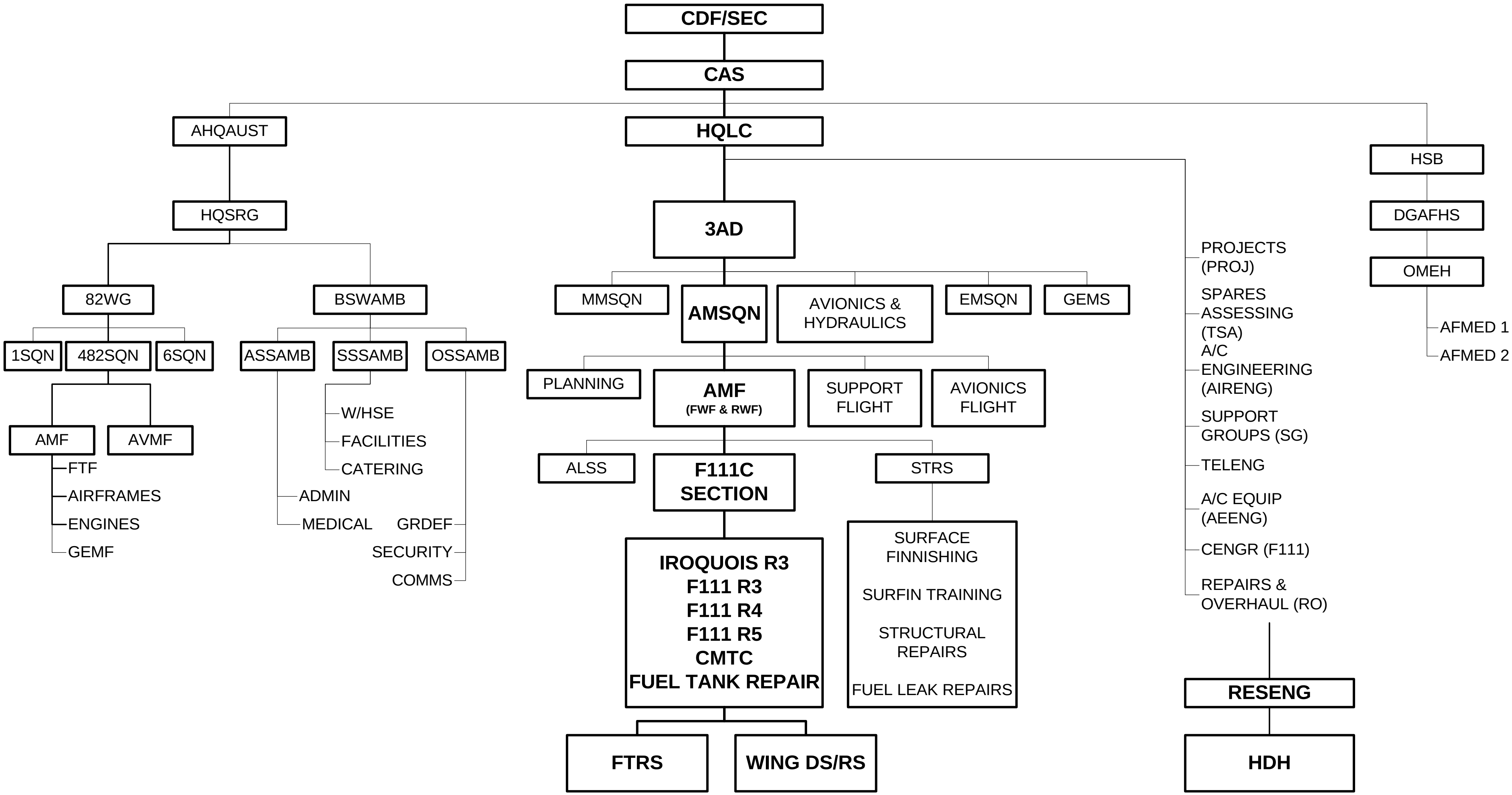
F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE 1988-1990



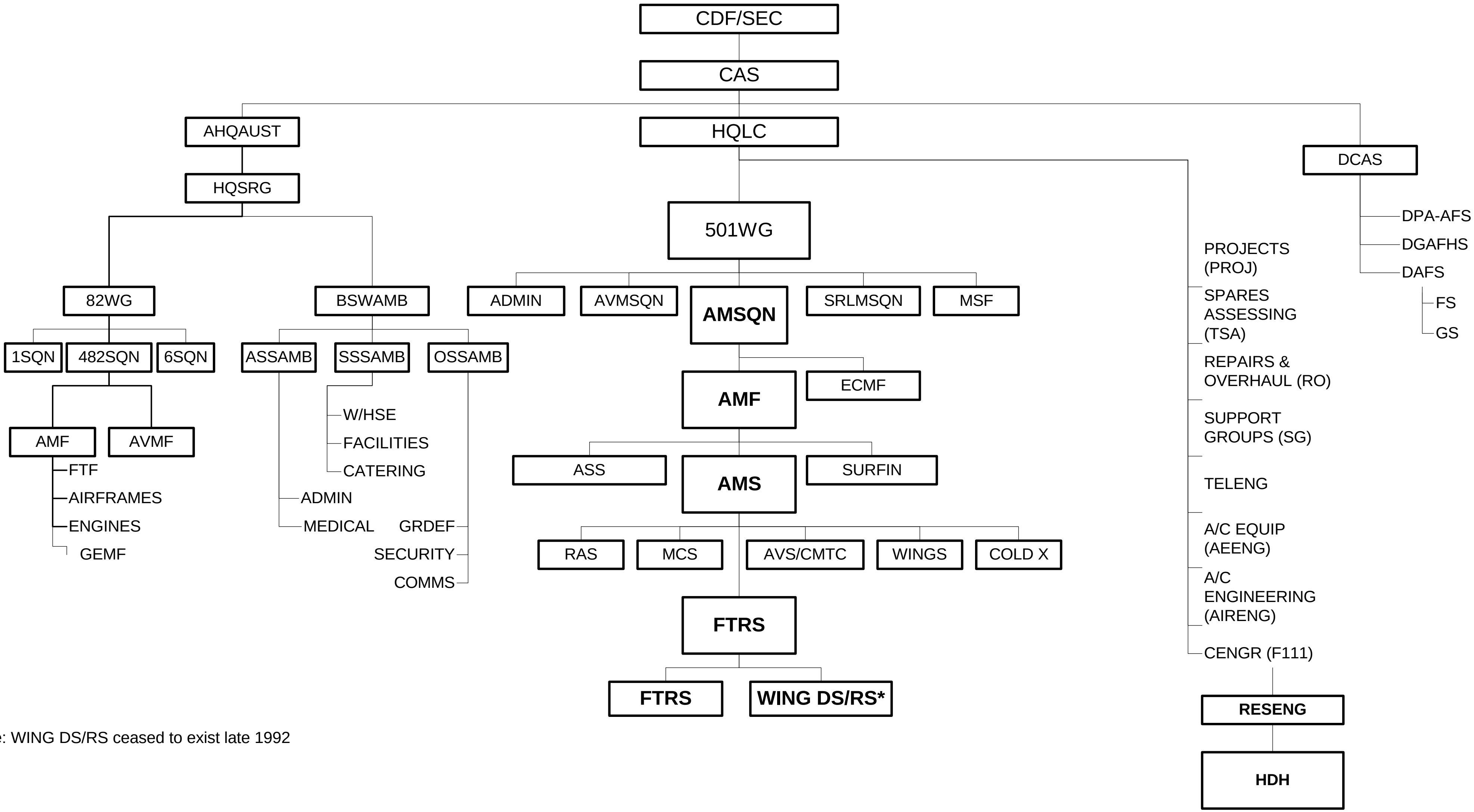
F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE 1991



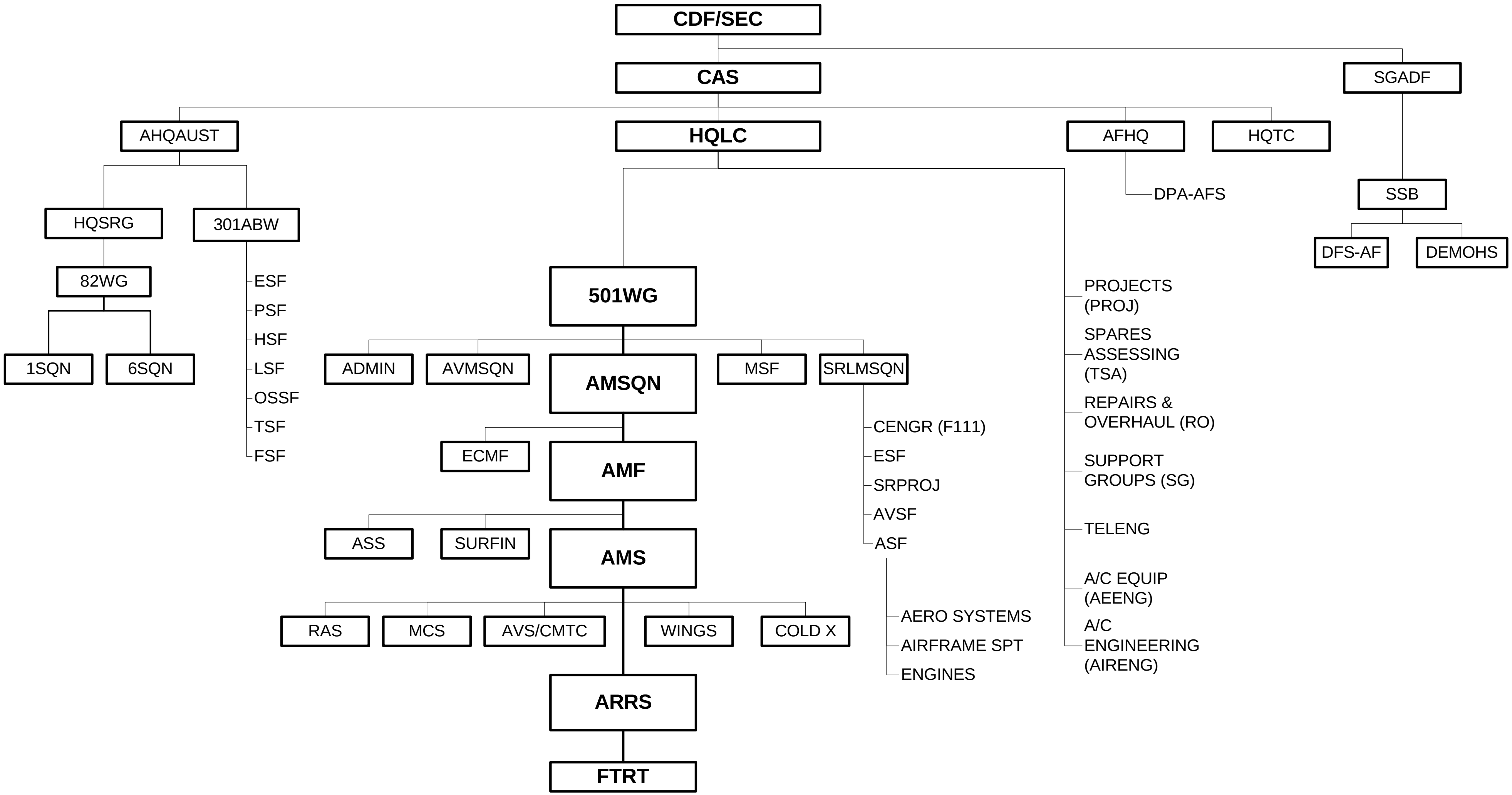
F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE 1992-1993



*****Note: WING DS/RS ceased to exist late 1992

RAAF ORGANISATIONAL STRUCTURE 1994-1996



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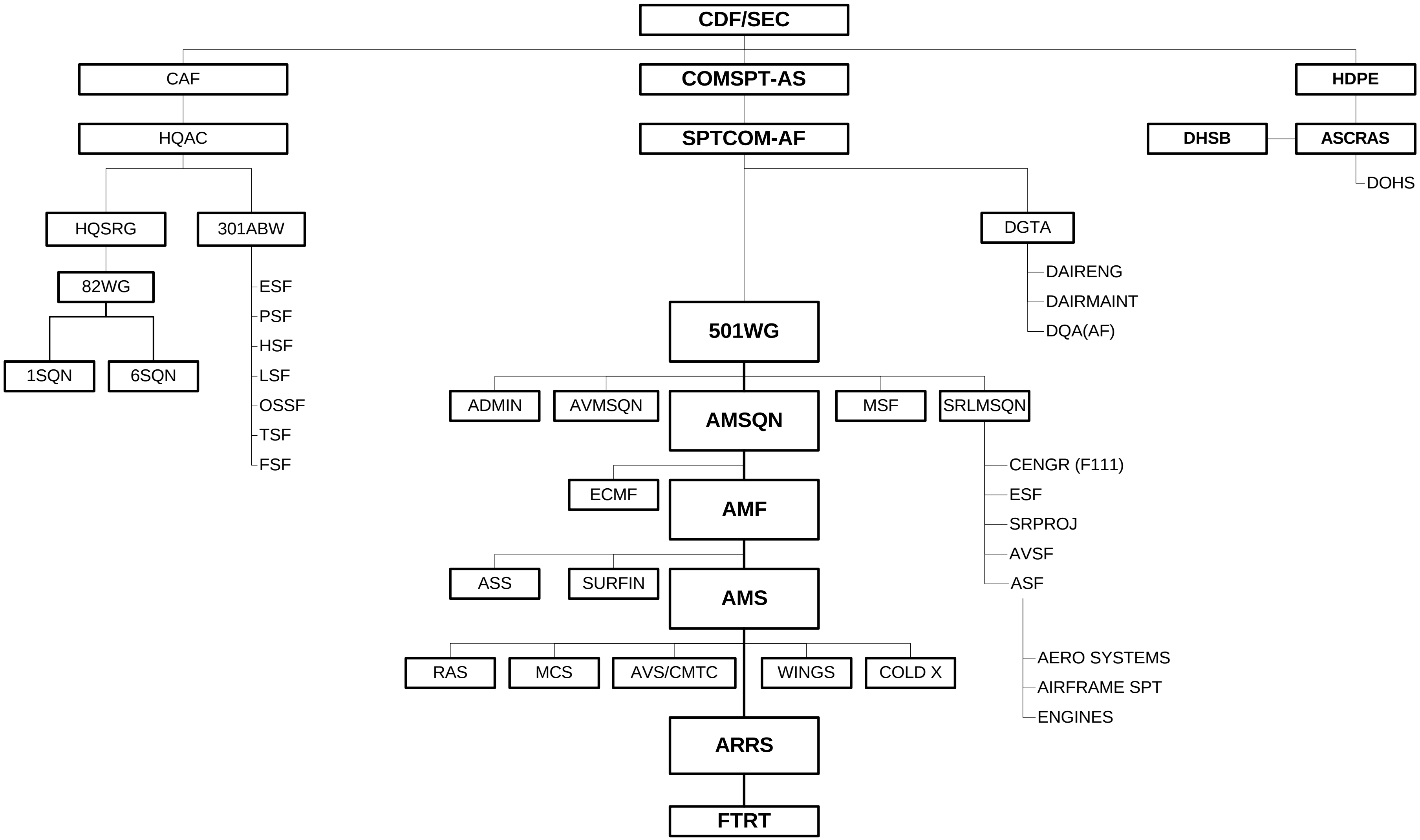
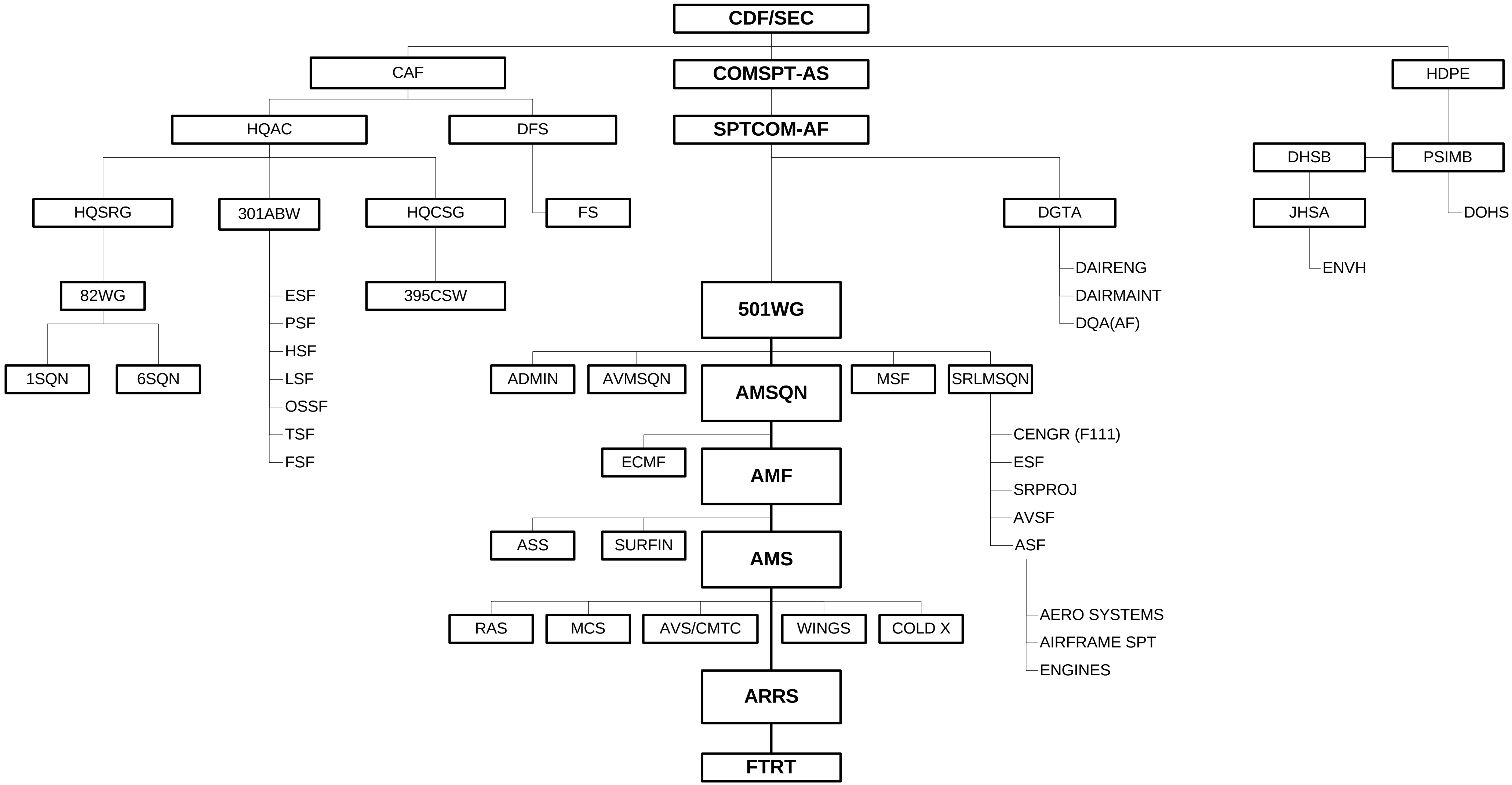
RAAF ORGANISATIONAL STRUCTURE
1997



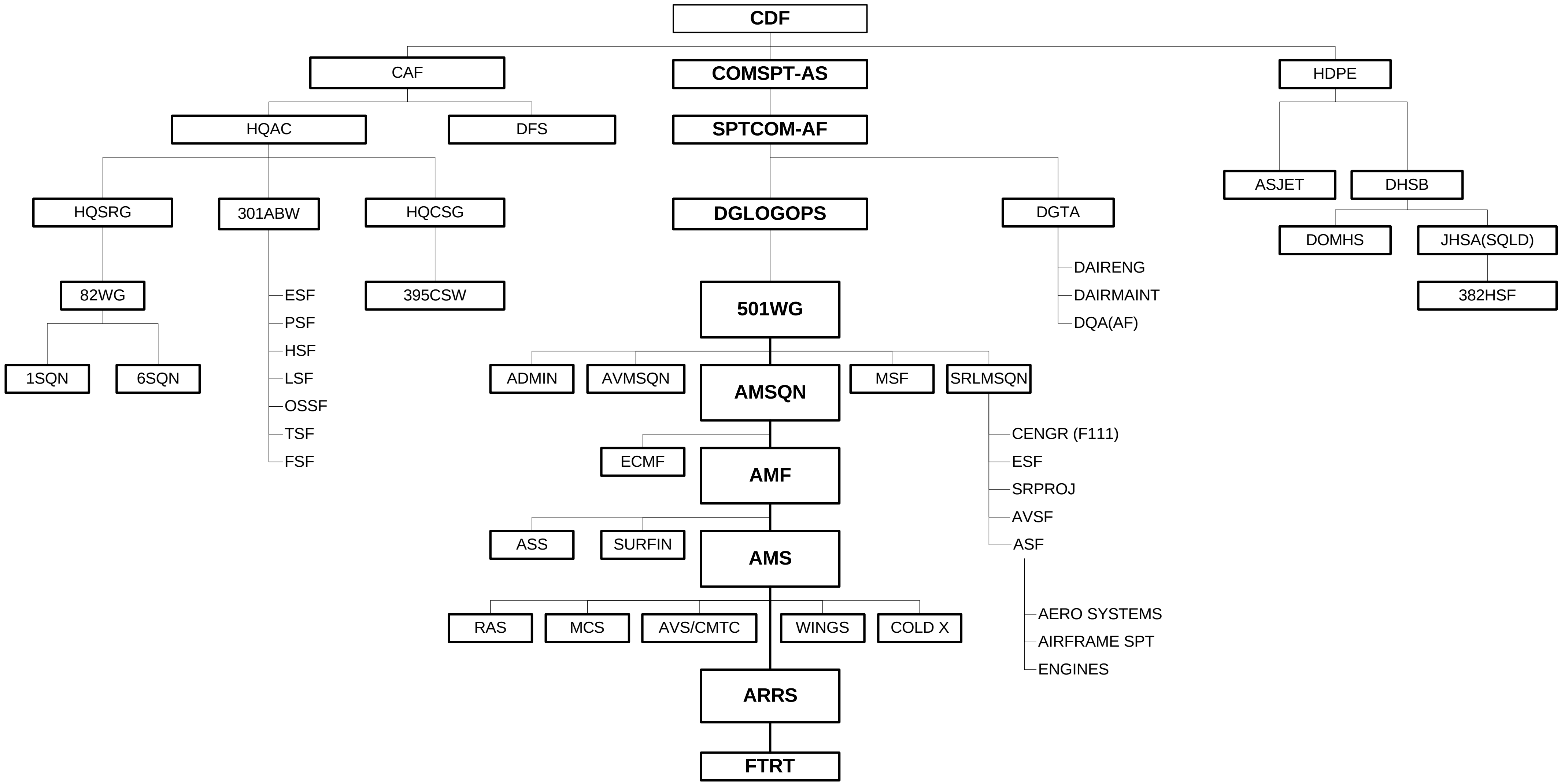
F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE 1998



F-111 Deseal/Reseal Board of Inquiry

RAAF ORGANISATIONAL STRUCTURE 1999



CHAPTER 1- SAFETY MANAGEMENT REGIMES

INTRODUCTION

1.1. An integrated Safety Management System (SMS) combines the elements of environment, safety and health into one system focused on allowing work to be accomplished safely.

1.2. The effectiveness of an SMS can be measured on how well it achieves its intended objective. The main objective of a SMS is to incorporate safety into management and work practices at all levels, addressing all types of work and all types of hazards to ensure safety for three sectors: the workers, the public, and the environment[1].

1.3. Most SMS models fall into two main categories, Organic Models and Systematic Models. Organic Models are overtly people-based and systematic models are closely aligned to compliance with environmental or quality standards.

Organic Model

1.4. This model begins and grows from the basic structure of a senior management safety committee, which aims to develop employee participation. Employee participation is considered highly advantageous, as the employee's work with the product and under the conditions on a daily basis and they often have the best knowledge of the hazards and can offer value judgements on the practicality of proposed solutions. Supervisors, management and other employees gradually work together in identifying and rectifying problems. Further teams are formed and additional training is made available. Eventually everyone is involved in the active maintenance of a safe work place creating an environment of 'collective responsibility'[2].

Systematic Model

1.5. A system approach is based on compliance with an accepted standard, usually the ISO 9000 standard for quality or the ISO 14000 standard for environmental management. Such an approach consists of a number of management layers, which establish the framework for the system and delineate responsibilities[3].

1.6. The Occupational Health & Safety (Commonwealth Employment) Act (1991) together with the common law duty of care principle are the legal imperative for employers to ensure a safe working environment. The provision of a safe working environment, maintained by a well-managed safety system, is also purported to be conducive of higher-level employee performance[4]. Recognition of such a link between safety and employee productivity/performance has been made at a strategic level of Defence, with the ADO Policy Statement making a clear connection between the maintenance of OH&S within defence workplaces and operational capability.

1.7. In order to identify an accepted model of an effective SMS, various Australian and international publications on SMS will be compared and contrasted. This process will highlight the elements generally accepted as necessary for an effective SMS.

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[1] Integrated Safety Management System Guide, US Department of Energy, http://www.doe.gov.
[2] CCH. Managing Occupational Health & Safety. Section 2610.
[3] CCH. Managing Occupational Health & Safety. Section 2-620.
[4] CCH. Managing Occupational Health & Safety. Section 2-000, at para 1.

A BRITISH SMS MODEL

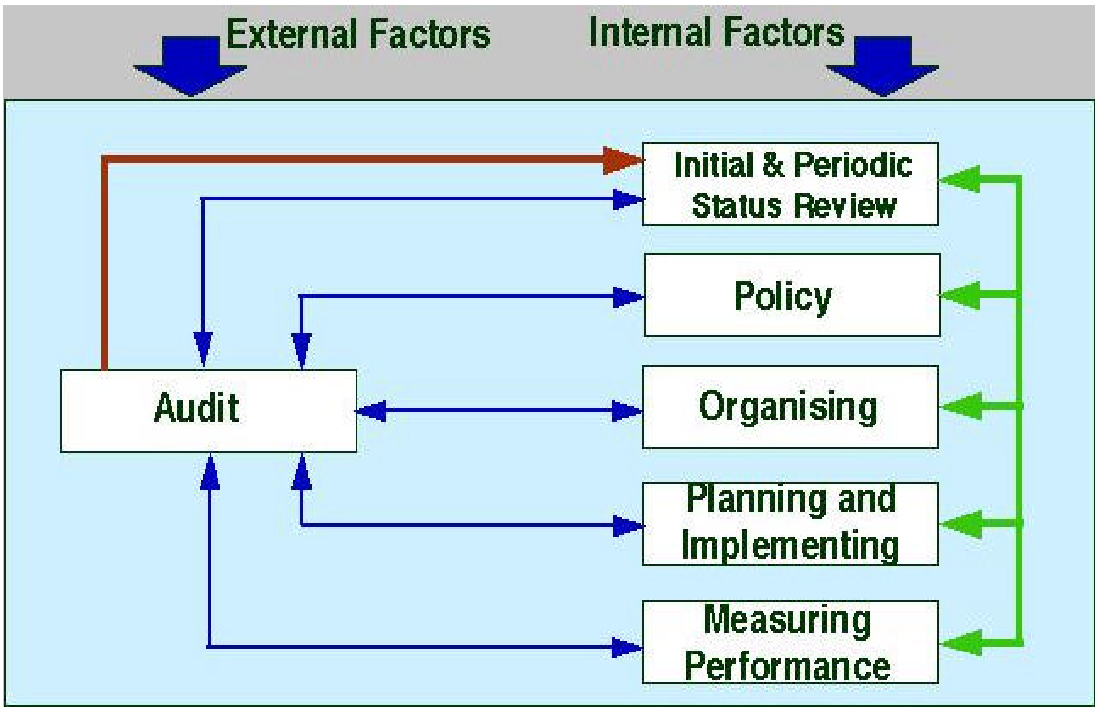
1.8. The British Standard 8800 (1996) Guide to Occupational Health and Safety Management Systems, defines a management system as:

> 'A composite, at any level of complexity, of personnel, resources, policy and procedures, the components of which interact in an organised way to ensure a given task is performed, or to achieve or maintain a specified outcome'[5].

1.9. The Standard provides two management system models for health and safety, one of which is based on ISO 14000 – Environmental Management Systems. Both systems contain the same key elements but in a slightly different order.

1.10. The second system is based on the United Kingdom Health and Safety Executive publication 'Successful Health and Safety Management' HS (G) 65[6] and the approach is summarised in the Figure 1 below, which is taken from this publication.

Figure 1 – Successful Health and Safety Management



1.11. The main elements as set out in the above Figure 1 are discussed in detail in the following paragraphs.

1.12. Initial Status review. This involves the identifying and evaluating the current arrangements for health and safety within the organisation and asking:

a. Do systems and performance standards exist?

b. Are they adequate (to meet objectives and comply with the law)?

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6 UK Health and Safety Executive (HSE) HMSO1991.ISBN 011 885988 9.

c. Do they meet best practice standards? and

d. Are they applied in practice?

1.13. Policy. The effective health and safety policy will be a plan of action, it will lead to the setting of clear objectives, and will make it clear that the organisation expects those objectives to be achieved.

1.14. Organising. This step involves putting in place the necessary structure with the aim of ensuring that there is progressive improvement in health and safety performance. It will require defining of :

a. duties and responsibilities for health and safety at all levels;

b. the person ultimately responsible for health and safety;

c. specific responsibilities for elements such as:

(1). training,

(2). monitoring compliance with the policy;

(3). sources of advice including the competent person(s) to assist; and

(4). contact with safety representatives.

d. Procedures and systems are very important but unless people are involved, committed and competent, the procedures are likely to be ineffective. Developing a positive safety culture involves five C's:

(1). Commitment;

(2). Co-operation;

(3). Communication;

(4). Control; and

(5). Competence.

e. Effective communication is difficult to achieve particularly in large organisations, but without it the other four C's cannot be achieved. Information about the safety management system the laws, standards, procedures and performance monitoring have to be communicated. Clearly discussion about health and safety issues is an essential part of the consultation process that leads to co-operation and shared values.

f. Since accidents are by definition unplanned and undesired events, it is clearly vital that proper control systems exist to ensure that only planned, desired events can happen. Control systems include all of the management procedures such as performance management and disciplinary procedures.

1.15. Planning and Implementing. Planning is essential in order to put policies into practice. It involves a systematic approach to:

a. Set Objectives and Targets

The priorities should be based on the risk assessment and the overall aim is for continuous improvement in health and safety performance. It is human nature that people will put most effort into those things upon which their performance is being measured. Although the ultimate health and safety goal of all organisations is zero injuries and ill health it is not a good idea to set objectives or performance targets based on a negative indicator such as accident statistics.

b. Identify Hazards and Assess Risks

Initially this can be done on a broad company wide scale to identify key areas for more detailed assessment.

c. Identify Performance Standards

If management achievement in health and safety is going to be measured, it is essential that everyone involved is aware of the standard against which they will be measured. Laws and Codes of practice, industry standards, British Standards etc. are all examples of minimum standards that must be met. In many cases it will be necessary to set company standards.

These standards may be defined in such documents as the company safety policy arrangements, in Standard Operating Procedures or in Quality Assurance systems and procedures. (The last two options will only be appropriate if health and safety aspects of the work have been included therein).

1.16. Measuring Performance. As with any business plan, it is necessary to measure performance against the objectives that were set. measurement techniques attempt to answer questions like:

a. How well are we performing in health and safety?

b. Are we progressing toward our objectives, if not, why not?

c. Are we complying with legislation?

d. What are our losses (time and money)?

e. How many injuries and cases of ill health have there been?

1.17. Measurement of health and safety performance falls into two categories , Active (or Proactive) and Reactive. Active monitoring involves checking to ensure that the safety management system as defined in the company policy is adequate and is being implemented, reviewed and updated. Progress toward specific health and safety objectives is also measured. Active monitoring measures the effectiveness of an organisation's defences against accidents whereas reactive monitoring simply measures the number of times those defences are breached.

1.18. Periodic Status Review. Steps 2 to 5 (ie. Policy, Organising, Planning and Performance Monitoring) must be reviewed from time to time to ensure that they remain valid and effective in creating continuous progress toward the organisation's ultimate aims for health and safety. Situations change, what would have been considered an effective safety management system twenty years ago would appear reactive and inappropriate today. The review should consider changed external factors such as new legislation, guidance, techniques, equipment, and internal factors such as reorganisation, new production line, acquisition, accident experience, audit results. Review procedures should be built into the system so that review is a continuous or at least a regular event.

Audit

1.19. In addition to regular routine monitoring carried out as part of measuring performance, there will be a need for audits that enable a deeper and more critical appraisal of all elements of the safety management system. The audit may cover the whole of the management system or just parts of it.

1.20. An audit is a formalised documented system designed to determine the efficiency, effectiveness and reliability of an organisation's safety management system.

1.21. Audits should ideally be carried out by an audit team, which would include managers and supervisors. Since knowledge of statutory requirements and other performance standards is needed, some training is essential for members of the audit team.

AN AMERICAN SMS MODEL

1.22. The model developed by the United States Department of the Environment (DOE) seems to be widely accepted and used in that jurisdiction. This model is set out in DOE P 450.4, Safety Management System Policy, which specifies a formal, organised process based on key guiding principles and core functions for ensuring the integration of safety into all types of work and for all types of potential hazards.

Purpose and scope

1.23. The DOE Safety Management System Policy [7] states that the purpose of a SMS is ‘to provide a formal, organised process whereby people plan, perform, assess, and improve the safe conduct of work.’ The system encompasses all levels of activities and documentation related to safety management throughout the organisation.

Policy

1.24. The DOE policy is that the SMS will be used to systematically integrate safety into management and work practices at all levels so that objectives are accomplished while protecting the public, the worker and the environment.

Components

1.25. The SMS consists of six components:

a. **Component 1**

Objective of Integrated Safety Management

(1). Safety must be integrated into all levels and all facets of work planning and execution.

b. **Component 2**

Guiding Principles for Integrated safety management.

These are the fundamental policies that guide the organisations actions, from the development of safety directives to the performance of work. They are:

(1). line management is responsible for safety;

(2). clear roles and responsibility;

(3). competence commensurate with responsibility;

(4). balanced priorities;

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7 http://www.doe.gov

(5). identification of safety standards and requirements;

(6). hazard controls tailored to the work being performed;

(7). operations authorisation; and

(8). worker involvement.

c. **Component 3**

Core Functions for Integrated Safety Management

The five core safety management functions provide the structure for any work that could potentially affect health or the environment. They are applied as a continuous cycle with the appropriate emphasis to address the type of work and the hazards involved. These core functions are:

(1). define the scope of work;

(2). analyse the hazards;

(3). develop and implement hazard controls;

(4). perform work within controls; and

(5). provide feedback and continuous improvement.

d. **Component 4**

Integrated Safety Management – Mechanisms

How the five abovementioned core functions are carried out is defined by Safety Mechanisms. The mechanisms will vary from facility to facility and from activity to activity based on the work done and the hazards involved. The mechanisms may include:

(1). the organisations expectations expressed through directives (policy, rules, orders, notices, standards);

(2). directives on identifying and analysing hazards and performing safety analyses; and

(3). directives which establish processes to be used in setting safety standards.

e. **Component 5**

Responsibilities for Integrated Safety Management

(1). Responsibilities must be clearly defined in documents appropriate to the activity. The associated approval authority needs to be established for each management mechanism used to satisfy a safety management principle or function,

f. **Component 6**

Implementation of Integrated Safety Management

(1). Implementation involves specific instances of work definition and planning, hazards identification and analysis, definition and implementation of hazard controls, performance of work, developing and implementing operation procedures, and monitoring and assessing performance for improvement.

1.26. An effectively integrated SMS must address the above stated principles and functions whilst considering the following:

a. The planning and performance of all types of potentially hazardous work, as well as design, conceptual studies, environmental analyses, safety analyses, and risk analyses;

b. All types of hazards, inter alia including chemical, occupational, environmental, electrical; and

c. The identification, analysis, control of hazards, the use of feedback for continuous improvement in defining, planning, and performing work.

EXAMPLES OF CONTEMPORARY AUSTRALIAN, SAFETY MANAGEMENT SYSTEM MODELS

Australian/New Zealand Standard 4804:1997

1.27. The standard provides guidance on the development and implementation of a systems approach SMS, the principles and their integration with other business management systems. The guidelines are intended as a voluntary internal management tool and are not to be used by certification bodies as a specification standard.

1.28. There are five progressive principal objectives underlying the proposed management system. The structure is underpinned by the notion of continual improvement and is said to be able to be applied generically to all organisations. The five basic principles are listed as:

a. **Commitment and Policy.** The allocation of resources is seen as a tangible representation of senior management commitment. A policy statement is required to clearly express the objectives and vision of the organisation so that all lower instructions or directions may be made in line with the intents of the executive policy.[8]

b. **Planning.** The planning phase involves the consideration of legal requirements, the identification of risks/hazards, the establishment of procedures, the formulation of well-defined and measurable outcomes and the designation of responsibilities.[9]

c. **Implementation.** According to the standard, implementation involves an organisational need to allocate adequate resources, identify the expertise and training required at all levels, develop communication systems to dispense OH&S information, arrange for the provision of services from any external or internal specialist agencies and promote employee consultation and

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8 AS/NZS 4804:1997. Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques. at pages 9 -12

9 AS/NZS 4804:1997. Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques. at pages 12-15

involvement. This process will effectively allow an organisation to establish an OH&S capability.[10]

d. **Measurement and Evaluation.** This is the essential process by which an organisation monitors its performance to ensure that it is meeting not only its own policy objectives but the legal requirements. Formal inspections serve to highlight hazards and to test the success of control mechanisms. Periodic Audits (internal and/or external) are stated as necessary to check that the OH&S system has been appropriately implemented and maintained. Audit results should be utilised in the management review process. Accident/incident investigations should be conducted by management or OH&S professionals to determine causal factors of incidents, in order that the actual core problems are uncovered. Timely corrective action should then be taken to rectify the situation.[11]

e. **Review and Improvement.** Management should periodically conduct a review of the system to ensure its continuing suitability and effectiveness with a view to achieving the original objectives set out in the policy statement. The concept of striving for continuous improvement is an important factor of an effective management system and the review process is central in providing indications of opportunities for such improvement.[12]

The DMS (AF) Model

1.29. Wing Commander John Michael Rowe is the Director Air Force Ground Safety Agency (AFGSA). Wing Commander Rowe developed a model of a SMS for the ADO.[13] The model describes a comprehensive system applicable to the needs of safety management in Defence.

1.30. The diagrammatic representation of the model depicts a 'wall' of safety elements, resting between two primary elements, Senior Management Commitment (which forms the 'foundation stone') and periodic Senior Management Review of the system in its entirety (the 'capstone').

1.31. Essential to the model is the commitment of Senior Management to the allocation of adequate financial and personnel resources. With relevant personnel being made aware of their specific responsibilities, their performance must then be assessed. This concept of performance monitoring is in line with the 'capstone' element where regular review of the system is considered necessary for continuous improvement.

1.32. In his evidence Wing Commander Rowe stated that such a review process is necessary to determine whether the system is structured and focussed correctly, whether the necessary information is provided to work-place members and finally how the system elements may be improved.[14]

The elements he proffered include the following which are consistent with other SMS Models:

a. OH&S Policy Statement;

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10 AS/NZS 4804:1997. Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques.at pages 15-29

11 AS/NZS 4804:1997. Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques. at pages 30-32

12 AS/NZS 4804:1997. Occupational Health and Safety Management Systems – General Guidelines on Principles, Systems and Supporting Techniques. at pages 32-34

13 MAN.0012.001, Statement of Michael Rowe.

14 MAN.0012.001, Statement of Michael Rowe.

b. Clearly Defined Responsibilities and Accountabilities;

c. Competency Based Training;

d. Procedural Instructions;

e. Clearly Defined Communication Channels;

f. Consultative Committees;

g. Health Surveillance;

h. Access to Specialist Advice;

i. Performance Monitoring;

j. Promotion and Awareness;

k. Incident Notification, Reporting and Investigation; and

l. Hazard/Risk Assessment and Control.

Group Captain Sargeant's Model

1.33. Group Captain Sargeant tendered this model as part of his evidence before the Board of Inquiry. GPCPT Sargeant was the OC of 501 WG from 1997 to 2000.

1.34. The model is based on the Australian Defence Technical Airworthiness Regulatory Framework (TARF) which was developed as a result of Blueprint 2020 [RAAF Engineering Planning Team, 1993]. The model is titled 'OH&S Regulatory Framework [OH&SRF]'. Group Captain Sargeant states that it is not a stand-alone blueprint but that it should be read together with the Technical Airworthiness Management Manual (TAMM) and Australian Standards 4801 and 4804.

1.35. Group Captain Sargeant makes a link between technical airworthiness and OH&S in order to justify using TARF as the basis for his model. He states that they both need a rigorous structure as a regulatory framework in order to guarantee safety. He does state though the OH&SRF will be much broader than TARF and will necessarily extend to non-technical items and processes.[15]

1.36. Critical success factors for the OH&SRF:

a. quality of OH&S decisions;

b. assured continuity of OH&S support in contingent circumstances;

c. responsiveness;

d. appropriate utilisation of industry capabilities and capacities; and

e. cost-effectiveness.

1.37. Desired Outcomes for the OH&SRF:

a. effective relationships with external agencies;

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[15] HRG.0001.001, Witness Statement of GPCAPT R J Sargeant.

b. adequate indigenous and in-house OH&S capabilities;

c. a policy, standards and regulatory framework consistent with world-best practice;

d. accreditation to appropriate quality standards;

e. improve management of the RAAF OH&S workforce;

f. an organisational based OH&S authorisation system that achieves competent decision making;

g. better OH&S management system;

h. the availability of an appropriately skilled and continuous OH&S workforce;

i. adequate resources including finance, IT, OH&S expertise and people; and

j. integration of OH&S decisions with those emerging from other management frameworks especially the TARF.

1.38. The proposed OH&SRF would reflect the structure of TARF and possess similar characteristics. It would also be implemented within the scope of AS4801 – Occupational Health and Safety Management System.

1.39. Amongst the elements of the OH&SRF are:

a. risk Management – hazard Identification/risk assessment/controls;

b. health surveillance;

c. hazard Information system; and

d. audits.

1.40. The Group Captain also states that the role of OH&S regulation should be assumed by DSMA and that the Occupational Health and Occupational Safety (Policy/Regulation) functions should be integrated under one body.

1.41. The Group Captain suggests that structure of the OH&SRF should be documented in a Manual, which would be similar in format to the TAMM and provide both guidance and mandatory regulations.

THE SAFETY CASE APPROACH TO RISK MANAGEMENT

Introduction

1.42. A Safety Case is a documented body of evidence that provides a convincing and valid argument that a system is adequately safe for a given application in a given environment[16]. The Victorian Work Cover Authority defines it as a 'written document in which the operator of a major hazard site describes what measures are in place to prevent a major incident and also to deal with the situation should such an incident occur'[17].

1.43. The Safety Case must demonstrate that the measures are appropriate and adequate, and that risks have been controlled as far as is practicable'[18]. The concept of a 'Safety Case' grew out of work in the nuclear industry and is now a familiar term in many industries. A Safety Case sets out the risks involved in the operation of a process or a piece of equipment and the possible consequences of a failure. It will specify what will be or has been done to minimise the probability and the impact of a failure[19].

1.44. A Safety Case, usually prepared in consultation with employees, should be a true reflection of the state of safety arrangements for the existing or proposed facility. It must demonstrate to the satisfaction of the designated authority, by its contents and supporting material, that the operator knows what technical and human activities occur, how they are to be managed and how safety will be assured in the event of an emergency. It must also identify methods to be used for the monitoring and reviewing of all activities in connection with the facility, with the view to the continual improvement of the safety of the facility[20].

1.45. There is nothing novel about the Safety Case concept. It is the adoption of simple common sense based on the following[21]:

a. identify the hazards;

b. prevent the incident from happening;

c. mitigate it's effects should it occur; and

d. escape if all else fails.

What Is A Safety Case

1.46. The term 'Safety Case' is used to describe a sophisticated, comprehensive and integrated risk management system. A Safety Case regime is characterised by an acceptance that the direct responsibility for the ongoing management of safety is the responsibility of the operators and not the Employer/Organisation, whose key function is to provide guidance as to the safety objectives to be achieved. The operators can achieve those objectives by developing systems and procedures that best suit their needs and agreeing on these with the Employer/Organisation. This 'Safety Case' then forms the rules by which the operation of the facility is governed[22].

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16 The SHIP Safety Case Approach – PG Bishop and RE Bloomfield, Adelard, Springer Publications. October 1995.

17 The Victorian WorkCOver Authority – Major Hazards. http://www.workcover.vic.gov.au/dir090/vwa/safehome.nsf/pages/so_majhaz.

18 http://www.workcover.vic.gov.au/dir090/vwa/safehome.nsf/pages/so_majhaz.

19 Illustrating the Safety Case – http://www.hcrc.ed.ac.uk/Annual Report95/Text/hi3-www.html

20 The Safety Case – S&E homepage http://www2.dme.wa.gov.au/minpetrol/safety/safetycase.htm.

21 Safety Case – John Fearnley , http://www.safety98.org/html/papers7/protected/d-10p.htm.

22 Introduction to the Safety Case Concept – Department of Industry Science and Resources

1.47. The Safety Case includes details of safety management arrangements and risk assessment studies, which, once submitted to and accepted by the Employer/Organisation, form a co-regulatory guidance document that sets both the standards to be achieved and the mechanism for achieving them.

1.48. The Safety Case also forms the basis for on-going audits of the facility and its operations, maintenance and modifications throughout its life. A key aspect of inspection/auditing by the Employer/Organisation is the monitoring of the effectiveness with which the commitments in the Safety Case are being implemented. This will provide a concrete assessment of the effectiveness of both the safety management system (SMS) and the operator's audits of the process. Furthermore it should provide the Employer/Organisation with a critical examination of managements efforts to actively involve the workforce in the Safety Case process.

1.49. The concept was developed in the United Kingdom to minimise major industrial hazards, mainly in the nuclear and chemical industries, and is now used to manage risk in a wide variety of applications. These include the control of risk in British naval operations, the safe operation of the privatised British railway system and the design of computer software programs. The Safety Case regime is normally based on a ‘co-regulatory structure', with an ‘operator' preparing and operating the facility for which the Safety Case is developed and a ‘Employer/Organisation' assessing, accepting and auditing the adequacy of the Safety Case.

1.50. A Safety Case serves two main purposes:

a. To give the ‘Employer/Organisation' (assessor) confidence that the ‘operator' has the ability, commitment and resources to properly assess and effectively control risks to the health and safety of staff and the general public; and

b. To provide a comprehensive working document against which the ‘operator' and the ‘Employer/Organisation' can check that the accepted risk control measures and safety management systems have been properly put into place and continue to operate in the way in which they are intended.

1.51. It is intended to be a ‘living' document which describes the safety of an operation for the duration of the whole project, from initial concept design to termination of the operation and abandonment of any facilities, and drives the continuous improvement of the risk management arrangements.

1.52. The European Standard EN 50129[23] identifies three different categories for Safety Cases:

a. Generic Product Safety Case (independent of application). A generic system that can be re-used for different independent applications.

b. Generic Application Safety Case (for a class of application). A generic application which can be re-used for a class/type of application with common functions.

c. Specific Application Safety Case (for a specific application). A specific application which is used for only one particular installation.

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http://www.isr.gov.au.

23 Undertaking a Safety Case In A Rail Environment, Odd Nordland SINTEF Telecom and Informatics System Engineering and Telematics at http://www.informatics.sintef.no/~nordland.

Background

1.53. The term 'Safety Case' derives from the concept of an operator making a case to the Employer/Organisation to prove that it is controlling risks properly in its operation of a particular facility.

1.54. The idea was initially developed by the nuclear power industry in the late 1960's/early 1970's, although the structure at that time lacked the well-developed risk assessment of the present system. Prior to this time, risk reduction in hazardous industries was accomplished by the imposition of specific legislation, which prescribed in detail what must be done by an operator to comply with the law.

1.55. In effect, the Employer/Organisation took on the responsibility of deciding what was or was not safe in a particular industry. Inevitably, rapid changes in technology meant that the legislation was constantly lagging behind development. Prescriptive legislation of this type bred a culture of minimum compliance, with industry complying with the letter of the law and no more. In the mid-1970's, the UK Health and Safety Executive (HSE) carried out extensive development work resulting in a marked increase in the sophistication of risk assessment techniques.

1.56. The mid 70's also saw the advent of a number of major industrial accidents – in particular the significant impacts of the fires and explosions at chemical plants at Flixborough UK, and Seveso Italy.

1.57. In 1982, as a result of the Seveso accident, the European Community (EC) developed the 'Seveso Directive' requiring countries to make national regulations controlling major industrial hazards. The HSE implemented a Safety Case regime under the Control of Industrial Major Accident Hazards Regulations 1984 (CIMAH) in response to the Directive, but this approach was not generally adopted throughout Europe.

1.58. In 1988, the Piper Alpha oil platform explosion and fire occurred in the UK area of the North Sea in which 167 persons were killed and losses estimated at upwards of 6 billion pounds sterling were suffered by the industry and the UK Government. The central recommendation of the public inquiry under Lord Cullen was that a Safety Case regime similar to CIMAH should be developed for offshore installations. The HSE set up an Offshore Safety Division to implement the recommendations, including the implementation of a Safety Case regime[24].

1.59. By that time, the features of the present day Safety Case concept were becoming widely accepted, namely that[25]:

a. direct responsibility for the on-going management of safety lies with the operators, not the Employer/Organisation;

b. the Employer/Organisation should, in consultation with those regulated, provide a framework of rules and the necessary motivation and discipline;

c. the process starts with a thorough risk assessment by the operator which shows what control measures are needed;

d. the operators be required to demonstrate to the Employer/Organisation (make a 'case') that they are controlling their risks properly and doing everything

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24 http://www.hse.gov.uk/hsehome.htm.

25 Introduction to the Safety Case Concept – Department of Industry Science and Resources http://www.isr.gov.au.

reasonably practicable for safe operation; and

e. control measures should concentrate on management systems rather than just hardware.

1.60. In 1992, the EC decided that the Seveso Directive was inadequate as it stood, and, as part of a wholesale revision of the Directive, adopted a Safety Case regime to control major hazards.

1.61. In the wake of the Piper Alpha disaster, an Australian Safety Case regulatory regime was introduced in 1992 to control safety in the offshore oil and gas industry. The Safety Case approach has also been applied more widely than just to offshore oil and gas platforms and other industrial facilities. In 1992, the UK government privatised British Rail, and, to reassure the public that the railways would still be safely operated, put in place Railway Safety Case Regulations modelled on the offshore Regulations.

1.62. In January 1996, the UK Ministry of Defence (MOD) introduced a Ship Safety Management System, which applies to all MOD marine operations and requires comprehensive Safety Cases for all new-to-service MOD ships and equipment. The Royal Australian Navy developed a Safety Case approach to manage the construction and operation of the new Huon class Mine hunters and is in the process of introducing its application, in some form, to all RAN operations. This is detailed in a subsequent Chapter of this Report.

1.63. The Australian Maritime Safety Authority has required the Tasmanian developers of a wave skimming ground-effect ship/aircraft to develop a Safety Case to cover proposed operations across Bass Strait.

1.64. In a suitably modified form, the Safety Case approach has also been widely used to manage risk in the development of computer software programs.

Elements of a Safety Case

1.65. The Safety Case concept requires the operator to formally document how risk is to be managed in its operations and across its facilities, to demonstrate that the major hazards of the operation have been identified and appropriate controls provided and that adequate provision has been made to ensure the safety of personnel in the event of an emergency. There are three broad categories[26] of information required in a Safety Case:

a. general information about the facility, its activities and operation and its interaction with other facilities or operations (the Facility Description);

b. the system by which safety is to be achieved and maintained in design, construction and operation of the facility, (the safety management system — SMS);

c. reasoned arguments and judgements about the nature, likelihood and impact of potential major hazards which may impact the facility and the means to prevent realisation of these hazards, or minimise their consequences should they occur (the Formal Safety Assessment—FSA).

Facility Description

[26] The Safety Case – S&E Home Page http://www2.wa.gov.au/minpetrol/safety/safetycase.htm.

1.66. The Safety Case should contain sufficient information about the facility to verify that the design and operating philosophy is consistent with the Safety Management System (SMS) and the assumptions and outputs of the Formal Safety Assessment (FSA).

1.67. The Facility Description should contain as a minimum the following information[27]:

a. a description of the facility, its purpose and its operation, including:

(1). an overview of the facility, highlighting key assumptions and operation phases of development;

(2). a summary of key design parameters with cross references to key technical documents;

(3). a description of the structure, its unique features (if any), equipment layout for all levels/decks;

(4). a description of the functions of the facility with reference to key processes;

(5). a summary of hazardous substances and inventories to be stored and/or handled on the facility;

(6). a description of the design safety philosophy, features and systems provided on the installation with emphasis on safety philosophy; and

(7). a description of key process equipment layout and process flow;

b. a description of interaction between the facility and its surrounding, including:

(1). interactions with existing facilities (physical connections, support from existing facilities, and interaction with any planned future facilities); and

(2). the inter-relationship between the facility and other facilities, industries or operations.

Safety Management System

1.68. The Safety Management System (SMS) is the central component of the Safety Case. It is the system by which hazards are identified and risks are continually and systematically assessed, and either eliminated or controlled from design through construction, commissioning, operation and disposal of the facility. In order to demonstrate that the operator has strategies, systems and procedures in place to comply with the various regulatory requirements that may be applicable, the SMS must be comprehensive, integrated and contain feedback loops that continually measure performance and drive change.

1.69. The activities undertaken by management to establish and operate an effective SMS are no different to those used to manage any other business. The same management features that underpin and distinguish organisations achieving business excellence form the basis of effective safety management.

1.70. The SMS would be expected to cover as a minimum:

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27 Introduction to the Safety Case Concept – Department of Industry Science and Resources http://www.isr.gov.au.

a. safety policies and the organisational and facility safety objectives;

b. organisation reporting structures - roles and responsibilities;

c. risk assessment and risk management;

d. methods of employee involvement in risk management;

e. employee selection, competency, training and induction;

f. integration of contractor and support services in risk management;

g. design, construction and commissioning procedures;

h. safe operational procedures for normal and abnormal circumstances;

i. systems of maintenance, inspection and modification;

j. systems of managing change to ensure safety;

k. methods, systems and procedures for ensuring the occupational health of employees;

l. emergency response including controls, personnel evacuation, escape and rescue;

m. incident investigation and reporting, corrective and follow-up action; and

n. the method of performance review and audit including review in the light of external experience.

1.71. The SMS should ensure that all necessary linkages between system elements are identified and, where appropriate, should draw on the principles of quality management.

Formal Safety Assessment

1.72. A Formal Safety Assessment (FSA) is an essential element in a modern risk management regime for major hazard installations. A FSA entails the identification and evaluation of hazards over the life of the project from the initial feasibility study through the concept design stage, to construction and commissioning, then to operation, decommissioning and disposal of the facility. It is a demonstration that, so far as is reasonably practicable, the risks to personnel have been minimised. It should;

a. provide reasoned arguments and judgements about the risk acceptance criteria including the rationale for their acceptance, references used and details of the risk acceptance studies conducted into potential major accident events that may occur during the life of the facility;

b. demonstrate that the operator has identified the nature, likelihood and consequence of potential major accident events that may occur at the facility;

c. state the associated risks of fatality with respect to employees at the facility, and that the likelihood of these events and/or consequences have been minimised over the life of the facility.

1.73. The FSA should also demonstrate that all reasonably practicable steps have been taken to ensure the safety of employees in the event of an emergency and during transit to a place of safety.

1.74. Both qualitative and quantitative methods of analysis can be applied to the assessment of risk. The 'operator' and 'Employer/Organisation' should discuss the appropriate methods of analysis for potential major accident events.

As Low As Is Reasonably Practicable (ALARP).

1.75. One of the objectives of a Safety Case is to demonstrate that risk from potential major accident events has been reduced to a level as low as reasonably practicable (ALARP).

1.76. The British Medical Association has produced a guide[28] that opens with the words 'Nothing in life is safe'. In a section on the acceptability of risk, the publication notes that the Association tries to avoid the use of the terms 'safe' and 'safety' as they 'imply zero risk, which for all practical purposes cannot be attained'.

1.77. The term 'as low as is reasonably practicable', when talking of levels of risk reduction, is used in recognition of this and of the fact that, in practice, there has to be a limit set on the amount of effort and resources that can be applied to the continued reduction of risk.

1.78. It is not possible to define ALARP in purely objective and absolute terms. There will always be a need for experienced judgement and subjective opinion - and hence always the potential for debate. Ultimately, whether ALARP has been reached may need to be decided in a court. A working definition (as developed by a an expert panel to satisfy duty of care requirements) of when a risk is ALARP includes:

a. the use of best available technology capable of being installed, operated and maintained in the work environment by the people prepared to work in that environment;

b. the use of the best operable and maintainable management systems relevant to safety;

c. the maintenance of the equipment and management systems to a high standard; and

d. exposure of employees to a level of risk which is low.

1.79. Additionally, the concept of reasonable practicability recognises that the cost and physical difficulty of avoiding the risk plays a part in the decision as to whether or not the risk levels associated with control measures adopted by the operator are acceptable. The decision will also take into consideration prevailing standards and the knowledge of the hazards and risks by personnel at the facility.

Quantitative Risk Assessment (QRA)

1.80. Quantitative Risk Assessment is a tool that can assist in the selection of acceptable solutions to safety problems. It is used to formally and systematically identify potentially hazardous events, and to estimate the likelihood and consequence to people, environment and resources, of accidents developing from those events.

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[28] British Medical Association http://dynix.bma.org.uk/.

1.81. The probability of an event occurring can be expressed quantitatively, and is based on the statistical analysis of historical data. When historical data is not available, or only available for facilities operating in different circumstances, it is necessary to rely on the opinions of experts to interpret data for comparable equipment or to make a best estimate.

1.82. The issue of whether or not the use of QRA is required to produce a good Formal Safety Assessment is still an area of debate. Ideally, the level of risk involved in the operation of a particular facility would be determined by quantitative risk assessment, and the assessed risk compared with some numerically defined targets or criteria. Where the assessed risk exceeded the criteria, the operator would be required to reduce risks to below those criteria.

1.83. The use of QRA is also felt to be more analytical and objective than mere qualitative statements or assertions, allowing critical areas of risk to be assessed and ranked in order of priority. Assumptions can be checked for sensitivity and the scope and/or depth of a Safety Case conveniently limited by demonstrating either that an adverse event has a very remote probability of occurring or that a particular consequence is relatively minor. A more convenient and clearer mutual understanding can be achieved. QRA also allows measurement against target criteria and comparison with other (and everyday) risks, and permits cost benefit considerations to be addressed objectively.

1.84. Unfortunately, QRA has a number of limitations, and debate continues worldwide about its precision, comprehensiveness, reproduceability and best use. Its use requires scarce, highly skilled (and expensive) staff. Often, adequate relevant historical data does not exist and worldwide data is not appropriate. In particular, there are substantial difficulties in defining the frequency or probability of human errors involving general activities such as poor design, ill considered plant modifications, poor supervision of work permits or poor operator training. (This factor is particularly relevant when it is noted that a high proportion of major accidents arise not from equipment failures but from these types of human errors).

1.85. The UK Health and Safety Executive, along with other Employer/Organisations, has moved somewhat away from their initial stringent quantitative analytical approach that potentially resulted in costly engineering solutions. In recognition of the limitations in applying QRA, HSE are moving to a more pragmatic approach, with greater emphasis being placed on safety management systems to reduce risk to as low as reasonably practicable.

1.86. At this time, indications are that QRA has an important part to play in analysing and understanding the degree of risk in a particular operation, but that the absolute value of any assessed risk is not suitable for use as the primary measure of the risk for regulatory purpose.

1.87. There is no explicit requirement for quantification of risk assessment in the preparation of Australian Safety Cases. The Safety Case Guidelines specify that acceptance criteria may be qualitative, quantitative or both. However, offshore operators generally include some degree of QRA in their Formal Safety Assessment.

Preparation of Safety Cases

1.88. The preparation of a Safety Case should involve close interaction between the ‘operator' and the ‘Employer/Organisation' (assessor), with regular meetings ensuring that the expectations of each party are reasonably in line as the development of the Safety Case proceeds.

1.89. Australian Employer/Organisations operate on the premise that issues should be resolved with the operator during the development or amendment of the Safety Case, and that there should be no surprises when the Safety Case is formally submitted.

1.90. The Safety Case need not contain detailed procedures, calculations, drawings or plans, but should contain sufficient information to allow the Employer/Organisation to assess whether the systems and conclusions presented in the Safety Case are reasonable. General documentary evidence that supports the conclusions reached in the Safety Case should be referenced, and the Employer/Organisation given access to the relevant documentation where necessary.

1.91. The use of external specialist resources to assist in the preparation of the Safety Case is commonplace. The operator should, however, be involved in all facets of the preparation of the Safety Case.

1.92. The establishment of an appropriate safety culture distinguishes organisations of excellence from those that are less well developed. An essential part of the development of an appropriate culture is the involvement of employees through their representatives in the preparation of the Safety Case and the active participation of employees in the maintenance of a safe place of work. The Safety Case will need to clearly identify the methods used to involve employees in safety management of the facility.

Assessment/Acceptance Of An Offshore Safety Case

1.93. The Employer/Organisation/assessor has a responsibility to assess the Safety Case material submitted by the ‘operator'. In the offshore situation, the Employer/Organisation is required by legislation to ‘accept’ the Safety Case after satisfying itself that the Safety Case objectives have been achieved. The responsibility for the quality of the Safety Case and its outcomes remains with the operator. This approach to Safety Case assessment and acceptance is paralleled in other industries where Safety Cases are required.

1.94. In the offshore situation, Safety Case guidelines have been developed to underpin the objective-based regime and to assist in the preparation, assessment and acceptance of a Safety Case. Whilst they are non-mandatory, they serve a number of functions:

1.95. Firstly, to assist operators in the preparation of Safety Cases. Secondly, they serve as a guide to the government Employer/Organisation responsible for assessing Safety Cases. Thirdly, the content provides the basis of further system analysis during the subsequent follow up verification - ie, audits which take place before the issue of the necessary acceptance by the Employer/Organisation.

1.96. The Safety Case Assessment Procedures provide a series of prompt questions under each of these system headings which serve as a guide to a Employer/Organisation in the analysis of the way in which the operator manages each system.

1.97. Each of the questions seeks information or directs the reviewer to examine the way in which the systems employed by the operator are:

a. planned - what objectives exist, what procedures and standards are in place;

b. organised - who is responsible for actioning the procedures and to what level and expected outcome;

c. implemented - how are the procedures implemented, resourced and how are competencies of personnel ensured; and

d. controlled - how the system is monitored, reviewed and audited and the results are used to update and improve the system's ability to produce the desired outcome.

1.98. Questions also prompt the reviewer to check for system linkages - that is, the way the operator ensures that where changes occur in work systems, other work systems register the change and adjust accordingly.

1.99. Inspectors are engaged both in on-site appraisal of the delivery of improvements and assessing the complex technical arguments put forward for alternative approaches. Reviewing the delivery of improvements is an integral part of a risk-based approach to offshore inspection.

1.100. The requirement to demonstrate that an organisation has successfully identified potential major accident events and assessed and demonstrated that risk has been reduced to as low as is reasonably practicable creates complex problems for drafters and assessors of Safety Cases.

1.101. Risk analysis, while it can employ scientific methodologies, is very much based on the experiences of those involved in undertaking the analysis, and where qualitative analysis is undertaken, by the data used in the assumptions made about likelihood and consequences of events. The result of these uncertainties is a process that is useful for comparisons, not a process that produces unequivocal measures of risk.

1.102. Demonstrating that the level of residual risk is acceptable will always be based on a degree of subjectivity. The Safety Case assessment procedures recognise the limitations of the risk analysis process and the problems associated with determination that risk has been reduced to as low as is reasonably practicable. This is achieved by focusing on the analysis of the operator's methodology in undertaking the risk analysis process. By checking the assumptions, outcomes and results for each phase of the risk analysis process, that is:

a. hazard identification;

b. hazard and risk assessment;

c. assessment of results; and

d. selection of control measures,

1.103. The assessor is undertaking a quality check of the adequacy of the study without duplicating the work.

On-Going Monitoring of The Safety Case

1.104. A principle feature of the Safety Case regime is the review and subsequent audit of the Safety Case against the performance standards stipulated in the Safety Case document.

1.105. Audit and review will generally take two forms. The first is associated with the acceptance of the initial Safety Case. Selected safety management systems will be the subject of an on-site review by the Employer/Organisation to assess the adequacy of the arrangements stated by the operator prior to the formal Acceptance of the Safety Case.

1.106. The second, conducted over the operational life of the facility, will be targeted audits of the operator's SMS based on a combination of performance measures including:

a. The operator's incident/accident experience and causal factors, complaints, legislative compliance reviews and the operator's internal audit results;

b. the combined national experience of operators;

c. national and international trends and experience; and

d. general industry experience and developing standards.

1.107. These performance measures will also assist in highlighting the need for regulatory guidelines to support the objective-based regulations.

1.108. Key aspects of inspection/auditing will be to monitor the effectiveness with which the commitments in the Safety Case are being implemented, monitoring the effectiveness of SMS and operator audits of them, and critically examining the efforts made by management to actively involve the workforce in the Safety Case process.

1.109. The quality movement has been a significant worldwide trend over the last several decades. A quality system shifts emphasis away from an individual task focus to a system-wide focus on quality. This is particularly relevant to inspectorial activity under a Safety Case regime. Prior to the advent of the Safety Case approach (and quality systems), the emphasis of inspections was placed on identifying areas of non-compliance with specific regulatory requirements, such as checking that the correct numbers of fire extinguishers were present and that they were all ‘in test'.

1.110. Under the new approach, the inspectorate emphasis is placed at a much higher level - with rigorous analysis of the overall safety management and hardware systems to uncover any potential weaknesses in the fundamental and comprehensive design of such systems. The inspector's task now, therefore, is rather to examine the design of the fire management system, and ensure that its structure includes mechanisms for ensuring and checking the adequacy and serviceability of the fire-fighting infrastructure.

Performance Measurement

1.111. Performance standards are the key to an effective safety system. They specify what has to be done, when, by whom, and to what extent and ensure that the system is operating as planned in the achievement of objectives through linking roles and responsibilities to actions in a measurable way.

1.112. Measurement of performance has traditionally been focused on ‘lag’ indicators such as Lost Time Injury Frequency Rates. Current thinking recognises that there are severe limitations in relying on such historical data, and instead is examining the use of ‘lead' indicators. Lead indicators (such as the number and quality of safety audits conducted, the measurement of management commitment to safety through employee perception studies, and the quality of the facility safety plan), will hopefully provide a real-time measure of the effectiveness of the safety management arrangements. They measure pro-activity, represent management's commitment to identify potential loss events, and signal the presence of management systems that can uncover weaknesses before they develop into full-fledged problems.

Effectiveness of the Safety Case System

1.113. The UK Health and Safety Commission published an interim evaluation of the effect of the implementation of the North Sea Safety Case regime in 1995[29], which (based on the

[29] *'An Interim Evaluation of the Offshore Installations (Safety Case) Regulations 1992'* 1995 HSE Books, PO Box 1999, Sudbury, Suffolk.

sample of figures produced by operating companies) estimated that average individual risk had been reduced by about 70% through its introduction.

1.114. The interim report also considered the views of industry managers and the offshore workforces. Recognition by managers of the value of improved understanding and management of risks was tempered by concerns with regard to the extent of reliance on, and the credence attached to, the results of QRA, the paperwork generated and the difficulty of workforce involvement in an inherently complex process.

1.115. More than 70% of workers surveyed said that they felt more confident about their safety now that every offshore installation must have an accepted Safety Case.

1.116. A major, independent evaluation of the legal regime governing safety on Britain's offshore oil and gas installations, which is governed by Safety Case Regulations, was conducted by Aberdeen University Petroleum and Economics Consultants Ltd (AUPEC) in 1999[30].

1.117. AUPEC's evaluation consisted of five elements:

a. a management survey;

b. a survey of the financial costs and benefits of the legal requirements;

c. work to follow up a survey of workforce views in 1994/95;

d. a review of published material examining the regime's effectiveness; and

e. a review of safety data from published statistics and independent research.

1.118. Researchers sought views from managers employed by a wide range of different types of organisation working offshore and from members of the workforce. Key findings of the study include:

a. the risk assessment process had enabled many companies to improve their understanding of the main risks;

b. an overwhelming majority of managers felt the regulations had improved their ability to manage safety;

c. all the companies interviewed for the cost and benefit survey stated that the regulations provided unquantifiable and consequential benefits, while the estimated costs were broadly in line with original HSE estimates (there were difficulties in allocating costs between the different regulations); and

d. there were major concerns about methodology and application of Quantified Risk Assessment.

AUSTRALIAN LEGISLATION ON SAFETY CASE

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30 *'Evaluation of the Offshore Safety Legislative Regime'*, AUPEC Ltd, Davidson House, Campus 1, Aberdeen Science & Technology Park, Balgownie Road, Aberdeen.

Victorian Occupational Health and Safety (Major Hazard Facilities) Regulations 2000[31]

1.119. The Regulations focus on the safety of people at major hazard facilities (workers, contractors and visitors), the safety of those who may be affected by an incident at a major hazard site (neighbours, local community) and the safety of property.

1.120. The Regulations give effect to the National Standard for the Control of Major Hazard facilities [NOHSC: 1014(1996)] and are similar to the regulatory requirements for such sites in Europe and also on Australia's offshore oil and gas facilities.

1.121. A site will be considered a major hazard facility primarily if it stores, handles or processes quantities of dangerous chemicals or products above a threshold, as defined in Schedule 1 of the Regulations. Typically, such facilities include refineries, chemical and gas processing plants, LPG storage and distribution sites and even certain types of large warehouses and transport yards.

1.122. The Regulations address key recommendations made by the Longford Royal Commission, including the recommendation that a Safety Case regime be implemented for the control of all major hazard sites in Victoria[32].

a. The Regulations set out specific obligations for companies operating major hazard facilities. Under the new laws operating companies must:

b. establish and implement a safety management system[33] ;

c. identify all major incidents that could occur, and the hazards that could cause those major incidents[34];

d. asses the risk of these hazards and potential major incidents[35];

e. adopt control measures to eliminate or reduce, as far as is practicable, risk to health and safety[36];

f. prepare emergency plans in conjunction with local emergency services and municipal councils[37];

g. consult with health and safety representatives in all relevant matters[38];

h. provide safety information to the local community and consult with municipal councils in relation to matters that could affect the local community[39]; and

i. prepare a Safety Case and apply for a license[40].

Notification and Registration

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31 Victorian Work Cover Authority – Safety Online http://www.workcover.vic.gov.au/dir090/vwa/safehome.nsf/pages/so_majhaz.
32 Regulation 401, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
33 Regulation 301, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
34 Regulation 302, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
35 Regulation 303, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
36 Regulation 304, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
37 Regulation 305, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
38 Regulation 501, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
39 Regulation 505, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
40 Regulation 401, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).

1.123. Under the Regulations, operators of existing facilities above 10% of the major hazard threshold were required to notify WorkCover of certain information by 1 August 2000. In addition, any person who has the intention to operate such a facility should also notify WorkCover at a suitable time[41] (this applies to facilities under development, undergoing expansion or about to change ownership).

1.124. Sites that handle these materials in amounts in excess of 100% of the specified threshold quantity will be automatically registered as major hazard facilities.

1.125. WorkCover can also determine sites between 10% and 100% of the threshold to be major hazard facilities where there is the potential for a major incident to occur[42]. However, WorkCover does not anticipate that a significant number of sites will be determined to be major hazard facilities - the regulatory impact statement conducted suggests 10 or fewer such instances. Unless a site of this type is determined to be a major hazard facility by WorkCover, notification is the only obligation under the regulations.

1.126. The Regulations contain all the information necessary to determine whether the facility meets the notification criteria. Additionally, WorkCover has prepared a Guidance Note to further explain the notification requirements.

Planning the Safety Case

1.127. Major hazard facility operators have up to 24 months from 1 July 2000 to complete their Safety Cases and submit them to WorkCover with an MHF licence application[43].

1.128. Prior to this, and within 90 days of Registration, they must also submit an Outline of their proposed Safety Case[44]. This outline must include a Project Plan, a Consultation Plan and certain other information.

1.129. The Safety Case Outline must be accompanied by a draft Emergency Plan.

Licensing

1.130. Operators must submit a Safety Case to apply for a license. The Safety Case must demonstrate that appropriate and sufficient measures are in place to control the risk of a major incident, as far as practicable.

1.131. Before issuing a licence, WorkCover will:

a. review the site's Safety Case;

b. conduct a site inspection;

c. review the site's systems and conduct an assessment of whether:

d. all major incident hazards are identified;

e. measures are in place to eliminate, prevent and manage major incidents;

f. the safety management system is adequate, implemented and maintained;

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41 Regulation 701,702,703, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
42 Regulation 705, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
43 Regulation 802, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).
44 Regulation 708, Occupational Health and Safety (Major Hazard Facilities) Regulations 2001 (Vic).

g. plant is adequately designed, constructed, operated and maintained;

h. procedures for consultation and information are in place; and

i. integrity controls are maintained.

1.132. After 31 December 2002 it will be an offence to operate a major hazard facility without a licence.

QUEENSLAND DANGEROUS GOODS SAFETY MANAGEMENT BILL 2001[45]

Development

1.133. The proposed legislation aims to achieve improved safety and enhanced efficiency of industry through a whole-of-Government approach to the safe management of hazardous materials in Queensland. The development of two National Standards by the NOH&SC has paved the way for this reform of Queensland legislation. These are the National Standard for the Storage and Handling of Dangerous Goods (In draft form currently) and the National Standard for the Control of Major Hazard facilities [NOH&SC: 1014(1996)]. Both adopt a performance-based approach, identifying safety outcomes, rather than prescribing the exact manner by which these outcomes are to be achieved.

Objective

1.134. The objective of the proposed Bill is to protect the safety of persons, and prevent damage to property and the environment, from hazardous materials[46]. A whole-of-Government integrated approach to the safe storage of hazardous materials and the control of major hazard facilities will be provided. The Bill will consolidate requirements under existing legislation and will simplify and streamline the legislative system for industry.

Scope

1.135. The broad areas to be addressed by the Bill are:

a. the imposition of a safety obligation on everyone involved in the storage, handling or control of hazardous materials[47]. [This safety obligation requires these people to take all reasonable precautions and care so that the risk is kept to an acceptable level];

b. the imposition of additional obligations on occupiers of major hazard facilities and dangerous goods locations[48];

c. providing powers for authorised officers and RACE advisers; and[49]

d. provisions for investigations and enquiries into major accidents.

1.136. The legislation will provide a framework for safe management of dangerous goods and combustible liquids by requiring an occupier to minimise risk by:

a. implementing measures to minimise the likelihood of accidents; and

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45 Queensland Department of Emergency Services – Information Paper no 14 http://www.thehub.com.au/~chem/index.htm.

46 Section 7 Dangerous Goods Safety Management Bill 2001 (Q).

47 Section 16 (1) Dangerous Goods Safety Management Bill 2001 (Q).

b. limiting the consequences of accidents if they do occur[50].

1.137. This will be achieved by requiring occupiers to develop and implement a safety management system including an emergency plan[51].

1.138. Occupiers of existing major hazard facilities will be required to notify the Chief Executive of the Department of Emergency Services within three months of commencement of this section of the Act[52]. It is proposed that this section will commence approximately six months after Proclamation of the Act. If the facility is then classified as a major hazard facility, the occupier must submit a safety report to the Chief Executive within 12 months of the classification[53].

1.139. The purpose of this safety report is to provide justification as to the adequacy of the measures taken to ensure safe operation of the facility. The safety report should cover other obligations under this Act, including:

a. systematic risk assessment;

b. emergency planning; and

c. safety management systems.

1.140. After an initial 12 month phase-in period, new facilities will be required to notify the Chief Executive six months before commencing operation, and submit a safety report three months before commencement of operation.

Powers of Authorised Officers

1.141. Authorised officers will have powers to enter major hazard facilities and dangerous goods locations to enforce this Act by conducting inspections and audits that monitor safety performance[54]. Once on-site, the authorised officer will have powers to inspect and copy documents, seize things or take samples, to ask questions and to ask for assistance from the occupier[55].

1.142. Authorised officers will be able to direct that reviews of safety studies are conducted, and if the risk is unacceptable, that the risk be reduced. In extreme circumstances, authorised officers will be able to direct that operations be suspended. In the case of major accidents, the authorised officer will be able to direct that the site be isolated[56].

1.143. Although the Bill does not specifically mention the term ‘Safety Case’ the actual effect of the provisions are the same. Section 23 and 41 of the Bill state as follows:

Section 23 - Obligations of occupiers

1.144. The occupier of a major hazard facility or dangerous goods location has the following obligations:

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48 Section 16 (2) Dangerous Goods Safety Management Bill 2001 (Q).
49 Sections 57-111 Dangerous Goods Safety Management Bill 2001 (Q).
50 Section 23 Dangerous Goods Safety Management Bill 2001 (Q).
51 Section 23(g) and 42 Dangerous Goods Safety Management Bill 2001 (Q).
52 Section 36 Dangerous Goods Safety Management Bill 2001 (Q).
53 Section 47 Dangerous Goods Safety Management Bill 2001 (Q).
54 Section 62 Dangerous Goods Safety Management Bill 2001 (Q).
55 Section 68-87 Dangerous Goods Safety Management Bill 2001 (Q).
56 Section 88-101 Dangerous Goods Safety Management Bill 2001 (Q).

a. as far as practicable, to minimise the risk associated with the major hazard facility or dangerous goods location by:

(1). eliminating or minimising hazards at the facility or location; and

(2). implementing measures to minimise the likelihood of a major accident at the facility or location; and

(3). implementing measures to limit the consequences if a major accident happens at the facility or location;

b. to ensure the safety of the occupier and employees while at the major hazard facility or dangerous goods location, including, for example, by providing and maintaining a safe place of work including safe storage or handling systems;

c. to record or be able to demonstrate the way the occupier has complied with the occupier's obligations under paragraphs (a) and (b);

d. in consultation with the employees at the facility or location, to establish, maintain and document emergency plans and procedures to:

(1). contain and control a hazardous materials emergency happening at the facility or location; and

(2). minimise the effect of the emergency on persons, property and the environment;

e. in consultation with the employees at the facility or location, to review and update emergency plans and procedures before any modification of the facility or location that would significantly alter the risk associated with the facility or location is undertaken;

Section 41 - Occupier must carry out systematic risk assessment

a. The occupier of a major hazard facility must, in consultation with the employees at the facility, carry out, document, review and update a systematic risk assessment that as far as practicable:

(1). identifies all hazards that may lead to a major accident at the facility;

(2). assesses the likelihood of a major accident happening at the facility and its effects if it does happen; and

(3). assesses the overall risk from the major hazard facility.

b. The systematic risk assessment must be carried out and documented:

(1). for a facility classified as a major hazard facility within 12 months after the commencement of this section—within 4 months after classification; or

(2). for a facility classified as a major hazard facility more than 12 months after the commencement of this section—within 3 months after classification.

c. The systematic risk assessment for a major hazard facility must be reviewed and updated before the facility is modified in a way that significantly alters the risk associated with the facility.

1.145. The approach taken under this Bill seems to clearly follow the Safety Case approach as well.

EXPERT REPORTS AND CASE STUDY

1.146. Two expert reports were commissioned by the Counsel Assisting Team to analyse the extant SMS within RAAF, and to provide possible alternative approaches to safety management. Both reports are referred to in Chapters 14 and 15 where the SMS is analysed at both the strategic and tactical levels. A case study was also undertaken to look specifically at how another organisation manages hazardous substances. For convenience the reports and case study are summarised below.

Aerosafe Risk Management Pty Ltd

1.147. Kimberley Turner, the Director of Aerosafe Risk Management Pty Ltd prepared a report for the Board of Inquiry with regard to Risk Management (RM) within the ADO[57].

1.148. Risk Management is stated as being recognised as an integral part of Safety Management. It is purported that the 'ADO cannot permit a degradation of combat power and readiness through preventable accidents or avoidable loss/damage to equipment or personnel'. This is the rationalisation for the use of risk management within the ADO.

1.149. According to the report, there has been no formal inclusion of risk management into the Defence Management Framework, particularly at Group level.

1.150. The report identifies that within the ADO there are currently over twenty-two RM policies in use, all reflecting different processes, methodologies and applications. The report suggests that there has been little or no cross-regulation or information sharing between the different organisations and commands developing these policies. In the opinion of the report writer this has resulted in a non-standard approach and unregulated development, which is not conducive to inter-operability within the Joint Operational environment.

1.151. The report identifies a lack of suitably qualified risk management and safety specialists within the ADO. As RM is a technical science it is considered essential for those developing policy and procedure to be appropriately qualified.

1.152. It is stated that through the adoption of a well-structured and coordinated approach, Risk Management will not only, significantly contribute to the maintenance of operational capability but also, through the reduction of loss, actually increase operational capability.

1.153. In order to determine whether risk was managed at 501WG in a structured, auditable way that is consistent with industry RM practices, the report includes (at Annex A) a comparison of 501WG risk management processes to the AS/NZS 4360:1999.

Geoff McDonald and Associates Pty. Ltd.

1.154. The Geoff McDonald Class 1 Damage Control Strategies Report[58] was prepared by Geoff McDonald and its stated aim is that it:

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[57] EXP.0009.001 F111 Deseal Reseal BOI Risk Management Report, Dated April 2001.
[58] The Geoff McDonald Class 1 Damage Control Strategies Report dated 23 Mar 2001.

> ‘Provides a strategic level report on the Geoff McDonald & Associates Occupational Health and Safety models as they would apply specifically to the Australian Defence Forces and outlines a model to be applied to the royal Australian Air Force[59]‘

1.155. The report identifies permanent life altering (Class 1) damage as representing 82% of the cost of damage at the workplace. Workplace health and safety is said to be ‘fundamentally a Class 1 problem’. The Report then goes on to describe various control strategies to reduce Class 1 damage.

1.156. There is detailed information of industry statistics on workplace occurrences, the type of damage caused and the cost incurred as a result of the damage. It also details how these figures can be utilised.

1.157. It sets out various models for collating and analysing data including a ‘Class 1 Taxonomy of Damaging Occurrences from Work, (which is a classification, in a wire diagram format), of the various Class one occurrences, the relationship between them and their relative importance. Various means of utilising this information to eliminate or reduce Class 1 damage are detailed. How this data is utilised under various different models is described in some detail.

1.158. The actual work system and procedures at 501WG is examined in detail and various Standards and their application is discussed with reference to photographs of actual work being conducted at 501WG. A comparison is made between the Control Strategies suggested by this Report and the Health and Safety Elements within 501WG.

1.159. A suggested approach for change is given in order to eliminate Class 1 Damage in the RAAF. The approach is based on the assumption that the RAAF wishes to be:

> ‘A challenged organisation seeking to place itself at the forefront of work health and safety by fulfilling the vision of eliminating Class 1 personal damage by using focused Veridical Knowledge[60]‘

Queensland Fire and Rescue Authority

1.160. The case study material was provided by Kevin Foster, who is the Operational Policy Advisor to the Queensland Fire and Rescue Authority (QFRA)[61]. For the purposes of this summary, the relevant areas of QFRA are, the Hazardous Chemicals Management Unit and the OH&S section. Mr Foster, along with Dr Michael Logan (Counter Disaster & Rescue Services Coordinator of the Chemical Unit) and MS Janet Richardson (Coordinator of Workplace Health & Safety for QFRA) produced a report for the BOI.

1.161. The QFRA has in place, a self-assessment program, maintained by the permanent positions of the regional Workplace Health & Safety Officers (WHSO). The WHSO within each regional facility monitors the individuals tasked with managing shop floor OH&S issues. The WHSO acts as an ‘educator’ and is responsible for the ongoing monitoring, assessment, education and training of personnel within the region.

1.162. The QFRA Code of Management prescribes the need to undertake regular checks in respect of OH&S issues. Recruits undergo an initial course in OH&S. The training for persons with OH&S responsibilities involves a full range of courses involving all matters relating to OH&S.

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59 The Geoff McDonald Class 1 Damage Control Strategies Report dated 23 Mar 2001 at page i.
60 The Geoff McDonald Class 1 Damage Control Strategies Report Dated 23 Mar 2001at page 216.
61 WIT.0524.001Queensland Fire and Rescue Authority – Report of Kevin Foster Dated 23 May 2001.

1.163. Committees are set up, and meetings are attended by representatives from each region including the WHSOs. The Committee meets every two months. The regional WHSO uses the meeting as a forum to report on the existing 'gaps' or issues involving OH&S within the organisation. The Committee is responsible for formulating policy and devising the associated implementation plans for this policy. In this was, a 'two-way flow' of information is created.

1.164. Performance-based auditing is conducted to ensure that individuals are participating in OH&S programs as well as complying with workplace OH&S standards. Individuals who do not meet these requirements are subject to counselling and regulatory action. Regulatory enforcement of OH&S is considered essential.

1.165. Personnel have access to a database with between eighty and ninety thousand listed chemicals. The database is updated every three to six months. The database is a combination of medical and chemical data. The medical data, in many cases, relates to the selection of PPE.

1.166. PPE worn by QFRA personnel is monitored closely. PPE is regularly updated and tested. QFRA does not rely solely on the information provided by manufacturers, choosing to conduct its own testing. A database put out by Dupont is used to assess permeation rates of PPE with regard to specific chemicals. Station Officer candidates are trained in Chemical Substances Management.

ANALYSIS

1.167. The Safety Case concept has been developed for reasonably complex major hazard facilities. The concept is replacing more prescriptive regimes. Prescriptive regimes are those in which the legislation obliges the operator to comply with a large range of detailed requirements. The onus is on the Employer/Organisation to ensure that the list of requirements is comprehensive and covers all eventualities, and that the operator is in compliance with them all.

1.168. The goal setting approach of the Safety Case concept places most of the responsibility back on the operator clarifying that it is those who create the risks to health and safety who are responsible for their control through the application of appropriate hardware and management measures. The Employer/Organisation still has the responsibility of ensuring that the operator meets these responsibilities. It is thus a co-regulatory approach to risk management.

1.169. It also provides the operators with greater freedom to develop their own solutions and reduces the potential for legislation to be a barrier to innovation.

1.170. The Safety Case approach provides the Employer/Organisation with an opportunity to examine risk management from a holistic perspective, including the way the operator manages the specific set of environmental, cultural and technical issues which distinguish the particular operation as unique. In addition, it provides a mechanism for overcoming the problem of redundancy in the regulatory system. When changes to technology, the state of knowledge or circumstances occur, there is often an administrative lag in the recognition and adoption of new legislation. Delays in legislative reform can impose a lower or lesser standard than would otherwise be acceptable.

1.171. After more than 20 years of development and implementation, the Safety Case concept can well be considered to be a mature, well proven and very successful approach to risk management.

KEY ELEMENTS OF AN EFFECTIVE SMS

1.172. Following analysis of the SMS models listed above and a number of others from various jurisdiction and organisations. It is apparent that, while the terminology used, the process order, and the emphasis may vary from model to model, they all contain the same basic key elements. The following summarises the general elements of an effective SMS against the key elements, namely:

a. Underlying Principles;

b. Policy Statement;

c. Process Elements;

d. Responsibilities.

Underlying Principles

1.173. A health and safety program is a definite plan of action designed to prevent accidents and occupational diseases. A health and safety program must include the elements required by the health and safety legislation as a minimum. Safety should be a prime consideration in the work practices of all personnel, at all levels. The development of a SMS involves integration of safety into all aspects of work planning and execution. Integration means that all facets of work planning and execution including programs, organisations and activities, are used to ensure that all relevant aspects of safety are addressed. This is especially important for programs and activities with conflicting or competing goals or requirements.

1.174. The SMS is not an 'optional extra or bolt-on to existing management activities'[62]. In order for a SMS to be effective, it has to be fully integrated into all management activities[63]. Health and safety issues need to be, included in all financial planning activities, accounted for and be integrated into the yearly budgetary process. Each level within the organisation has its own obligations and responsibilities to those working with them, for them and to those who work under their direct supervision[64].

Policy Statement

1.175. An organisation's occupational health and safety policy is a statement of principles and general rules that serve as guides for action. Senior management must be committed to ensuring that the policy is carried out with no exceptions. The health and safety policy should have the same importance as the other policies of the organisation.

1.176. The policy statement can be brief, but it should mention:

a. management's commitment to protect the safety and health of employees;

b. the objectives of the program;

c. the organisation's basic health and safety philosophy;

d. who is accountable for occupational health and safety programs;

e. the general responsibilities of all employees;

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62 Queens University- Health and Safety Management System, http://www.safety.queensu.ca/mgmt/hsmgmtsys.htm.

63 HRG.0001.001, Witness Statement of GPCAPT Sargeant dated 28 Feb 2001, para 89 and Statement of WGCDR Brett Wood, at page 29 para 92.

64 MAN.0023.001Statement of Captain McKinnie RAN dated 08 May 2001, page 2 para 10 'Safety needs to be an element of an integrated response that is owned by the individual and the organisation'.

f. that health and safety shall not be sacrificed for expediency; and

g. that unacceptable performance of health and safety duties will not be tolerated.

1.177. The policy should be:

a. stated in clear, unambiguous, and unequivocal terms;

b. signed by the incumbent Chief Executive Officer;

c. kept up-to-date;

d. communicated to each employee; and

e. adhered to in all work activities.

SMS Process Elements

1.178. While organisations will have different needs and scope for specific elements required in their health and safety program, the following basic items should be considered in each case:

a. Individual responsibility;

b. Joint occupational health and safety committees;

c. Health and safety rules;

d. Correct work procedures;

e. Employee orientation;

f. Training;

g. Workplace inspections ;

h. Reporting and investigating accidents;

i. Emergency procedures;

j. Medical and first aid;

k. Health and safety promotion;

l. Workplace specific items;

m. Individual OH&S Responsibilities;

n. Workplace audits ; and

o. Risk management.

Individual Responsibilities

1.179. Health and safety is the joint responsibility of management and workers[65]. Management is accountable for non-compliance to health and safety legislation. All health and safety activities are based on specific individual responsibilities, most of which can be

[65] Transcripts\Apr09.doc - bjsarg1Transcript of Proceedings dated 9 Apr 01, evidence of BJ Sargeant, page 552-553 states that safety is everyone's responsibility through the command and management chain. MAN.0023.001Statement of Captain McKinnie RAN dated 08 May 01, page 3 para 11 '…emphasises the need for every organisation and individual to be responsible for the actions taken to improve safety…'

found in the pertinent legislation. However, often these duties are not well known[66]. This situation can be improved by including details of specific individual responsibilities in the safety program.

1.180. Responsibility may be defined as an individual's obligation to carry out assigned duties. Authority implies the right to make decisions and the power to direct others. Responsibility and authority can be delegated to subordinates, giving them the right to act for superiors. It is important to note that, while some responsibilities can be delegated, the superior remains accountable for seeing that they are carried out.

1.181. Individual responsibilities apply to every employee in the workplace, including the chief executive officer. When a safety coordinator has been appointed, it is best to spell out his/her responsibilities as well. All employees will then know exactly what is expected of each individual in health and safety terms[67].

1.182. To fulfil their individual responsibilities, the people must:

a. know what these responsibilities are[68] (communication required);

b. have sufficient authority to carry them out (organisational issue);

c. have the required ability and competence (training or certification required); and

d. Once all these criteria have been met, safety performance can be assessed by each individual's supervisor on an equal basis with other key job elements. Health and safety is not just an extra part of an employee's job: it is an integral, full-time component of each individual's responsibilities.

1.183. Examples of responsibilities of workers include:

a. using personal protection and safety equipment as required by the employer;

b. following safe work procedures;

c. knowing and complying with all regulations;

d. reporting any injury or illness immediately;

e. reporting unsafe acts and unsafe conditions;

f. participating in joint health and safety committees; and

g. undertaking OH&S training.

1.184. Examples of responsibilities of first-line supervisors include:

a. instructing workers to follow safe work practices;

b. enforcing health and safety regulations;

c. correcting unsafe acts and unsafe conditions;

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66 Transcripts\APR10.DOC - jmrowe1Transcript of Proceedings dated 10 Apr 01, evidence of JM Rowe, at page 610 states that there is a 'lack of clearly articulated policy on roles and responsibilities in terms of a occupational health and safety management system…'

67 Transcripts\APR10.DOC - jmrowe2Transcript of Proceedings dated 10 Apr 01, evidence of JM Rowe, at page 611 states 'keyplayers need to be made aware of their responsibilities…';
Transcripts\Apr09.doc - bjsarg3Transcript of Proceedings date 9 Apr 01, evidence of BJ Sargeant, at page 544 states the importance of people understanding what their responsibilities are.

68 Transcripts\Apr09.doc - bjsarg4Transcript of Proceedings dated 9 Apr 01, evidence of BJ Sargeant, at page 548 states that division of responsibilities is not necessarily a problem if people understand….

d. ensuring that only authorised, adequately trained workers operate equipment;

e. reporting and investigating all accidents/incidents;

f. inspecting own area and taking remedial action to minimise or eliminate hazards;

g. ensuring equipment is properly maintained;

h. promoting safety awareness in workers; and

i. participating in the workplace committees.

1.185. Examples of responsibilities of management include:

a. providing a safe and healthy workplace;

b. establishing and maintaining a health and safety program;

c. ensuring workers are trained or certified, as required;

d. reporting accidents and cases of occupational disease to the appropriate authority;

e. providing medical and first aid facilities;

f. ensuring personal protective equipment is available;

g. providing workers with health and safety information;

h. supporting supervisors in their health and safety activities;

i. evaluating health and safety performance of supervisors;

j. ensuring adequate resources for workplace health and safety; and

k. participating in consultative forums (Committee meetings).

1.186. Examples of responsibilities of safety coordinators include:

a. advising all employees on health and safety matters;

b. coordinating interdepartmental health and safety activities;

c. collecting and analysing health and safety statistics;

d. providing health and safety training;

e. conducting research on special problems; and

f. attending health and safety committee meetings as a resource person.

Workplace Health and Safety Committee

1.187. An effective safety program needs the cooperative involvement of all employees. A Workplace occupational health and safety committee is a forum for cooperative involvement of employees representing both labour and management. Such committees are statutory requirements for organisations of a specified minimum size in most jurisdictions.

1.188. A joint health and safety committee brings together the work-force’s in-depth, practical knowledge of specific jobs and management's larger overview of job interrelationships, general company policies and procedures. This team can be more effective in solving health and safety problems than a single individual.

1.189. To function properly, the committee needs an appropriate structure, a clear statement of purpose and duties, and standard procedures for meetings. An employer does this by establishing terms of reference for the committee and by allocating adequate resources.

1.190. Once the committee members have been chosen, the committee should participate in decisions on the details of its structure, duties, and procedures. An early key decision that should be made is the question of reporting structure responsibility.

1.191. In a general sense, each committee member is responsible to the chairperson(s), and the committee as a whole to all employees for fulfilling their duties. However, if prompt follow-up to recommendations is to be expected, one individual should be named as a person in authority. The best choice is usually a member of senior management in the line organisation. This individual will have sufficient authority to be able to take or expedite direct action as required.

1.192. The joint occupational health and safety committee members should be active participants in the development, implementation, and monitoring of all phases of the health and safety program.

Correct work procedures

1.193. Governmental health and safety regulations represent minimum requirements. In almost all cases, organisations will have to augment these regulations with specific rules. These rules must be followed to achieve a healthy and safe workplace.

1.194. We need rules to protect the health and safety of workers-but there are dangers in having either too few or too many rules. Too few rules may be interpreted as a sign that health and safety are not important, or that common sense is all that is required to achieve them. Too many rules may be seen as not treating employees as thinking adults and makes enforcement of all rules less likely. Following are some guidelines for establishing rules:

a. rules should be specific to health and safety concerns in the workplace;

b. the joint occupational health and safety committee should participate in their formulation;

c. rules should be stated in clearly understandable terms;

d. rules are best stated in positive terms (‘employees shall’ not ‘employees shall not’);

e. the reasons for the rule should be explained;

f. rules must be enforceable, since disregard for one rule will lead to disregard for others;

g. rules should be available to all employees in written form, in the languages of communication of employees; and

h. rules should be periodically reviewed to evaluate effectiveness and to make changes for improved effectiveness.

1.195. Compliance with health and safety rules should be considered a condition of employment. Rules must be explained to new employees when they start work or if they are transferred or retrained. After a suitable interval, these employees should be briefed to ensure they understand the rules applicable to their work.

1.196. The employer must establish procedures for dealing with repeat rule violators. Supervisors are responsible for correcting unsafe acts, such as a breach of rules, and they must be supported in this duty. Points that should be considered in establishing procedures on this issue are:

a. ensure that employees are aware of the rule;

b. ensure that employees are not encouraged, coerced, or forced to disregard the rule by fellow employees;

c. all rules are to be observed;

d. no violation will be disregarded;

e. the role of discipline is that of education, not punishment;

f. action is taken promptly;

g. while having guidelines for penalties for the first offence or infractions may be desirable, some flexibility is required when applying the guidelines since each case will vary in its circumstances; and

h. action is taken in private, and recorded.

1.197. Establishing correct work procedures:

a. Correct work procedures are the safest way of performing a job, undertaking job instruction, monitoring performance, and accident investigation;

b. Job safety analysis (JSA), also known as ‘job hazard analysis’, is the first step in developing the correct procedure. In this analysis, each task of a specific job is examined to identify hazards and to determine the safest way to do the job[69]. Job safety analysis involves the following steps:

(1). select the job;

(2). break down the job into a sequence of steps;

(3). identify the hazards;and

(4). define preventive measures.

1.198. The analysis should be conducted on all critical tasks or jobs as a first priority. Critical jobs include:

a. those where frequent accidents and injuries occur;

b. those where severe accidents and injuries occur;

c. those with a potential for severe injuries;

d. new or modified jobs; and

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69 Transcripts\APR10.DOC - sseck1Transcript of Proceedings dated 10 Apr 2001, evidence of WGCDR SW Secker, page 636 states ‘...you identify the range of hazards in a particular work environment you’ve got to integrate the responses of each of those hazards into the final solution…’

e. infrequently performed jobs, such as maintenance.

1.199. Job safety analysis is generally carried out by observing a worker doing the job. Members of the joint health and safety committee should participate in this process. The reason for the exercise must be clearly explained to the worker, emphasising that the job, not the individual, is being studied. Another approach, useful in the analysis of infrequently performed or new jobs, is group discussion.

1.200. A work procedure may consist of more than one specific task. In such cases, each separate task should be analysed to complete a job safety analysis for that procedure. The final version of the correct work procedure should be presented in a narrative style format that outlines the correct way to do the job in a step-by-step outline. The steps are described in positive terms, pointing out the reasons why they are to be done in this way. Reference may be made to applicable rules and regulations and to the personal protective equipment required, if any. Employees who carry out the tasks should be consulted in developing the procedure.

Employee Induction

1.201. Health and safety education should start with employee induction when an employee joins the organisation or is transferred to a new job[70]. It has been found that inexperienced workers, in general, are involved in accidents at a higher rate than others. While experience can only be gained through time, both health and safety education and job skills training can be used to improve this record. Induction sessions normally cover such items as explanation of the function of the work unit, organisational relationships, administrative arrangements, and miscellaneous policies and rules.

1.202. Items related to health and safety that should be included are:

a. emergency procedures;

b. location of first aid stations;

c. health and safety responsibilities, including those specified by legislation;

d. reporting of injuries, unsafe conditions and acts;

e. use of personal protective equipment;

f. right to refuse hazardous work;

g. hazards, including those outside own work area; and

h. reasons for each health and safety rule.

1.203. A new employee can be expected to absorb only a certain amount of information in the first few days. A brochure outlining the points covered in the orientation sessions is useful as a handout to employees. It also serves as a checklist for the person conducting the orientation. A buddy system is a useful follow-up to the initial orientation. This allows for on-the-job reinforcement of the information presented to the new employee. This process promotes the safety awareness of the experienced workers who are the ‘buddies’.

1.204. New, inexperienced or transferred employees should be encouraged to ask questions at any time when doubt exists as to correct procedures. The new employee orientation may include a set of questions, such as the following:

a. What are the hazards of the job?

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[70] MAN.0012.001, Witness Statement of JM Rowe dated 2 Apr 01, at page11 par e. addresses this issue.

b. Is job safety training available?

c. What safety equipment do I need to do my job?

d. Do I need to wear personal protective equipment (PPE)? Will I receive training on how to use the PPE?

e. What do I do in case of fire or another emergency?

f. Where do I find fire extinguishers, first aid kits, first aid rooms and emergency assistance?

g. What are my responsibilities regarding health and safety?

h. If I notice something wrong, to whom should I report?

i. Who is responsible for answering safety-related questions? and

j. What do I do if I get injured or have an accident?

1.205. Soon after the orientation sessions, employees should be assessed on their understanding of the items discussed. In this way, both the quality of training and the level of understanding can be evaluated.

Training Program

1.206. The objective of training is to enable effective implementation of health and safety policies into specific job practices and to raise awareness and skill levels to an acceptable standard. While all employees can benefit from health and safety training, special attention should be given to the training of supervisors, trainers, and workers. Occasions when employee training may be required are:

a. commencement of employment;

b. reassignment or transfer to a new job[71];

c. introduction of new equipment, processes, or procedures; and

d. inadequate performance.

1.207. The National Safety Council in the United States suggests that the following topics be included in supervisory safety training:

a. safety and the supervisor;

b. know your accident problems;

c. human relations;

d. maintaining interest in safety;

e. instructing for safety;

f. industrial hygiene;

g. personal protective equipment;

h. industrial housekeeping;

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[71] Transcripts\May9.doc - mck1Transcript of Proceedings dated 09 May 01, evidence of Captain McKinnie RAN, page 38 ‘ we provide OH&S1 and 2 training to all our Leading Seamen being promoted to Petty Officers’.

i. material handling and storage;

j. guarding machines and mechanisms;

k. hand and portable power tools; and

l. fire protection.

1.208. At the workplace the supervisor is generally responsible for much of the training of workers. This duty, however, is often delegated to an experienced worker. To be an effective instructor, an instructor should:

a. receive training in how to instruct;

b. prepare an orderly plan for instruction; and

c. explain reasons why each step must be done in a certain way.

1.209. All instructors should be taught how to proceed when training a new or inexperienced employee:

a. plan the session beforehand; break the job down into steps; have training aids available;

b. explain what is to be done;

c. describe all the hazards and protective measures;

d. demonstrate each step, stress key points, and answer any questions;

e. have the employee carry out each step, correct errors, and compliment good performance; and

f. check frequently after the employee is working independently to ensure correct performance.

1.210. Documented correct work procedures are an invaluable aid in job skills training. External sources for training assistance are industry associations, unions, government agencies, and professional consultants.

Workplace Inspections

1.211. Workplace inspections identify existing hazards and recommend appropriate corrective action. In many jurisdictions, Health and safety legislation requires workplace inspections as a proactive action to ensure workplace health and safety[72].

1.212. Supervisors and workers are responsible for reporting and taking action on unsafe conditions and acts as they are encountered. The frequency of planned formal inspections may be set out in legislation. Records of previous accidents and the potential for serious accidents and injuries are factors to be included when determining if more frequent inspections are needed.

1.213. Joint health and safety committee members seem the obvious choice of personnel to carry out formal inspections, especially if they have received training or certification. Other criteria for selecting the inspection team are:

a. knowledge of regulations and procedures,

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72 Transcripts\Apr09.doc - gtye1Transcript of Proceedings, page 565 dated 9 Apr 2001, evidence of Glen Tye, recommending workplace inspections.

b. knowledge of the hazards in the workplace, and

c. experience with work processes involved.

1.214. Pre-planning any inspection is always worthwhile. Documents such as previous inspections, accident investigations, maintenance reports, and safety committee minutes, should be consulted. If a checklist is to be used, it should be reviewed and changed to meet specific needs of the workplace.

1.215. Checklists are useful aids in that they help ensure that no items are overlooked in an inspection. While many ready-made checklists are available in safety literature, it is best to adapt these to local conditions. The joint health and safety committee should participate in the preparation of these tailor-made checklists.

1.216. During the actual inspection, both work conditions and procedures should be observed. If a hazard that poses an immediate threat is discovered, preventive action must be taken right away, not after the inspection. Notes are made, specifying details of the hazard, including its exact location. When completing the inspection report, it is a good idea to classify each hazard by degree of possible consequences (for example: A = major, B = serious, C = minor). In this way, priorities for remedial action are established.

1.217. Inspections serve a useful purpose only if remedial action is taken to correct shortcomings. Causes, not symptoms alone, must be rectified. Corrective action should be taken immediately, with the emphasis on engineering controls, management failures, or need for worker education, whatever applies.

Accident Reporting and Investigations

1.218. Occupational health and safety legislation requires that injuries and certain categories of accidents must be reported. There may be minimum legal requirements for their investigation. Realising the value in so doing, many organisations investigate lesser accidents (where damage did not involve injuries) and ‘where someone shows enthusiasm for an issue’[73].

1.219. The SHE Pacific Report states that:

> ‘The best practice organisations uniformly agreed that it was important to report and investigate non-injury incidents, as well as those that caused injury. They were adamant that it was often only luck that was the difference between a very serious injury and one that was only a ‘near miss’[74].

1.220. The health and safety program should specify:

a. what is to be reported;

b. to whom it will be reported;

c. how it is reported;

d. which incidents are investigated;

e. who will investigate them;

f. what forms are used;

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73 MAN.0113.001, Witness Statement of WGCDR Brett Wood, at page11 par 32.
Transcripts\May9.doc - mck2Transcript of Proceedings dated 09 May 01, evidence of Captain Mckinnie RAN, at page 709.

74 Review of the DEFCARE Computer System, February 2001, SHE Pacific at page 32.

g. what training investigators will receive;

h. what records are to be kept;

i. what summaries and statistics are to be developed; and

j. how often reports are prepared.

1.221. Accidents and incidents are investigated so that measures can be taken to prevent a recurrence of similar events. Investigation represents an 'after-the-fact' or reactive response for any particular mishap. However, a thorough investigation may uncover hazards or problems that can be eliminated 'before there is an incident' or proactively for the future[75]. After causes have been determined, prompt follow-up action is required to achieve the purpose of the investigation.

1.222. 'Through the incident investigation process, the real causes of the incident were revealed. Individual investigations generated a list of actions required to fix the issue. Progress against the completion of actions was monitored in best practice organisations, although to varying success. The information on the causes of incidents and injuries was used for trend analysis and for targeting the areas that would result in organisational improvement'[76].

Emergency Procedures

1.223. Emergency procedures are plans for dealing with emergencies such as fires, explosions, major releases of hazardous materials, violent occurrences, or natural hazards. When such events occur, the urgent need for rapid decisions, shortage of time, lack of resources, and lack of trained personnel can lead to chaos.

1.224. The objective of the plan is to prevent or minimise fatalities, injuries, and damage. The organisation and procedures for handling these sudden and unexpected situations must be clearly defined. The following must be considered and/or undertaken:

a. The development of the plan follows a logical sequence.

b. Compile a list of the hazards (for example: fires, explosions and floods).

c. Identify the possible major consequences of each (for example: casualties, damage).

d. Determine the required countermeasures (for example: evacuation, rescue, and firefighting).

e. Inventory the resources needed to carry out the planned actions (for example: medical supplies, rescue equipment, training personnel).

f. Based on these considerations, establish the necessary emergency organisation and procedures.

1.225. Communication, training, and periodic drills are required to ensure adequate performance when the plan must be implemented.

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75 MAN.0007.001, Witness Statement of Hal Waddington dated 12 Mar 01, at page 16 par 63 'the absence of a well defined incident investigation model also ensures that root causes of incidents will not be found and the opportunity to address them lost.' Statement of WGCDR Brett Wood, at page11 par 32. Transcripts\May9.doc - mck2 Transcript of Proceedings dated 09 May 01, evidence of Captain Mckinnie RAN, at page 709.

76 Review of the DEFCARE Computer System, February 2001, SHE Pacific at pages 31-32.

Medical and First Aid Programs

1.226. First aid facilities and the provision of medical aid is generally prescribed under health and safety legislation or workers' compensation legislation. The OSH program must include the following information:

a. location of first aid stations and medical facilities;

b. identification of first aid attendants;

c. identification of other staff trained in first aid;

d. health surveillance;

e. policy on pre-employment and follow-up medical examinations;

f. procedures for transporting injured employees to outside medical facilities;

g. provision of first aid training;[77] and

h. procedures for recording injuries and illnesses.

1.227. A policy on return to work after a lost-time accident might appropriately be included in this section of the program. The fact that 'light duties' or 'modified work' is a controversial issue is all the more reason for the organisation to agree on a clear policy that is known by all employees. In some jurisdictions, modified work rules are covered by legislation.

1.228. In general, if injured workers are offered alternative employment:

a. the work must be suitable and productive;

b. the worker's physician must agree that such employment will not harm the worker or slow down the recovery;

c. the worker will pose no threat to other workers;

d. the policy is also applied to off-the-job injuries; and

e. under no circumstances should the reduction of severity ratings be a reason for initiating a 'modified work' program.

Employee Involvement

1.229. Once the health and safety program has been set in place and the program appears to be running smoothly, effort is still required to maintain enthusiasm and interest. Studies have shown that the effectiveness of health and safety educational techniques depends largely on how much importance management is seen to place on health and safety. Where management, by its actions, has shown that they are sincerely concerned, interest in the program can be maintained at a high level. Accountability for individual performance is a key motivator[78].

1.230. Safety awareness can be enhanced by:

a. the setting of realistic goals and monitoring progress;

b. Distribution of all pertinent information;

[77] Transcripts\APR10.DOC - jrowe2Transcript of Proceedings, evidence of WGCDR JM Rowe, at page 613 states 'I would expect (medical) to provide certified first aid training..'.

[78] Transcripts\Apr09.doc - bjsarg5Transcript of Proceedings dated 09 Apr 2001, evidence of BJ Sargeant, at page 544 states 'its important people understand what their responsibilities are… but that doesn't remove the requirement of accountability'.

c. individual recognition for superior performance;

d. general meetings, informal discussion, and one-on-one coaching; and

e. Well-designed incentive programs.

Workplace Specific Items and Health and Safety Programs

1.231. The elements of OH&S programs discussed so far apply to all basic health and safety programs. In addition, specific items may be needed to address workplace specific activities. Examples of such items are:

a. Workplace Hazardous Materials Information System (WHMIS);

b. lock out procedures;

c. hot-work permits;

d. material handling rules;

e. plant maintenance;

f. fire safeguards;

g. vehicle safety rules;

h. confined space entry;

i. off-the-job safety;

j. working alone guidelines;

k. personal protective equipment requirements;

l. engineering standards;

m. purchasing standards; and

n. preventive maintenance.

Implementation of an Occupational Health and Safety Program

1.232. A good health and safety program provides a clear set of guidelines for activities that, if followed rigorously, will reduce accidents and cases of occupational disease. The key to success is the manner in which the program is implemented and maintained.

1.233. Senior management must demonstrate commitment and support the program by:

a. providing resources such as time, money, and personnel; [79]

b. ensuring that employees receive training or certification as required;

c. making all applicable health and safety information available to all employees entitled to receive it;

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[79] Transcripts\Apr09.doc - bjsarg5Transcript of Proceedings dated 9 Apr 01, evidence of BJ Sargeant, at page 544 states 'you cant ask people to exercise accountability if you're not prepared to provide them with the resources to do so…'.
Transcripts\APR10.DOC - jrowe2 Transcript of Proceedings dated 10 Apr 01, evidence of JMRowe, at page 611 states that 'Senior management have got to provide the resources necessary to run an occupational health and safety management system….'

d. including health and safety performance as part of employee performances appraisals at all levels; and

e. attending health and safety meetings.

1.234. The program must be communicated to all employees. Special emphasis should be given to new workers, newly appointed supervisors, and new members of the joint health and safety committee. Revisions to policies and procedures should be publicised. The program should be available in a single written document. However, if separate manuals have been developed for various elements, such as accident investigation procedures, their use should be referred to in the main document.

Evaluating a Health and Safety Program

1.235. Accident frequency and severity rates are an inadequate measure for evaluating the effectiveness of a health and safety program. Cases of occupational disease are under-reported in these statistics. The emphasis is usually on injury-producing accidents alone, not all accidents. Since accidents are rare events, in small organisations the basis for comparison may be limited, especially in small organisations. Chance is a factor both in frequency and severity.

1.236. Rather than relying solely on injury rates, or after-the-event measures, it is desirable to use an audit as a before-the-fact measure of the effectiveness of an OH&S program[80]. An audit uses a checklist in which each element is subdivided into a series of questions. Each question is given a weighting factor depending on its importance. Records, observations, interviews, and questionnaires are used to evaluate performance for each sub-element.

1.237. A number of audit systems are available. The number of elements considered in an audit range dramatically, for example from twelve (DSMA Audit Tool[81]) to thirty (British Safety Council). In many of these ready-made audit systems, the standards are based on what leading organisations have determined to be the acceptable levels of performance.

1.238. Annual audits appear to be the norm, but reviewing critical elements in the program more frequently may be advisable. The audit team, which should include representation from the joint health and safety committee, must receive appropriate training in audit procedures[82].

1.239. The audit identifies weaknesses in the health and safety program. Little is achieved unless a procedure is established to ensure prompt follow-up on deficiencies. This procedure should include provision for target dates for remedial action and checks to confirm completion.

Risk Management

1.240. Risk management is a process involving well-defined steps that support better decision making by contributing to a greater insight into risks and their impacts[83]. By adopting effective risk management techniques, safety, quality and efficiency can be improved.

1.241. The main elements of risk management are:

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80 Transcripts\Apr09.doc - bjsarg6Transcript of Proceedings dated 09 Apr 01, evidence of BJ Sargeant, at page 553 states the importance of an audit.
MAN.0023.001Statement of captain McKinnie RAN at page 25 para 109 'The effectiveness of the regulatory system are measured by audits'.

81 DSMA Intranet WebPages, http://dsma.dcb.defence.gov.au/wsm/audit/audit frame.asp

82 Transcripts\May9.doc - moy1Transcript of Proceedings 09 May 01, Evidence of LTCOL DJ Moylan at page 654.

83 What is Risk Management? , A Standards Australia Portal, RISKMAN/INFO/WHATISRM/WHATISRM.htm

a. Hazard identification;

b. Risk assessment;

c. Establishment of risk controls; and

d. Linking risk to management activities.

e. The benefits of risk management include:

f. more effective strategic planning;

g. increased knowledge and understanding of exposure to risk;

h. a systematic, well informed and thorough decision making process;

i. increased preparedness for third party review;

j. minimised disruptions to work;

k. better utilisation of resources; and

l. strengthening culture for continued improvement.

1.242. There are a number of levels of risk management[84]. These are:

a. Activity based risk management. This applies to the daily workings of the organisation. The job safety analysis discussed above would form part of this level of risk management.

b. Operational level risk management which is essentially tactical level risk management . This level is a useful tool for middle to senior management in quantifying the cost of doing business[85].

c. Strategic risk management, which encompasses elements of business planning and strategic planning[86].

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84 EXP.0009.001Aerosafe paper on Risk Management Within the Australian Defence Organisation at page 12

85 EXP.0009.001Aerosafe paper on Risk Management Within the Australian Defence Organisation at page 13 par b.

86 EXP.0009.001Aerosafe paper on Risk Management Within the Australian Defence Organisation at page 13 par c.

CHAPTER 2 – EXTANT RAAF SAFETY MANAGEMENT SYSTEM

INTRODUCTION

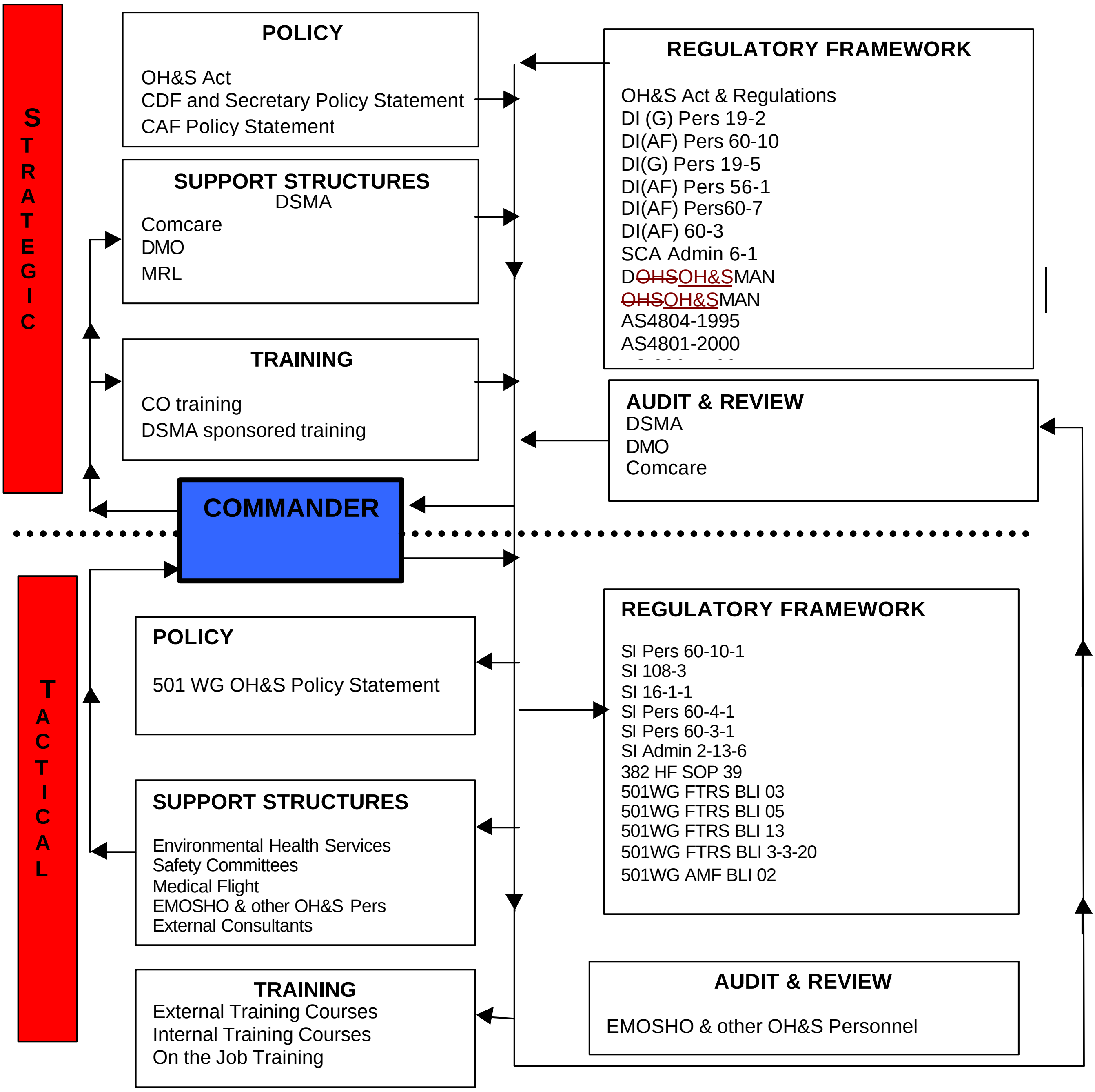
2.1. This chapter examines the extant Safety Management System (SMS). An examination of the extant system will focus on that which is in force in the RAAF, with particular emphasis where necessary, on the regime applied during the Spray Seal Program at 501 WG. This chapter is written from the perspective of a Commander. It is intended that in so doing the existing SMS within the RAAF can be better understood from the perspective of the individual who is charged with OH&S obligations from both legal and policy directives.

2.2. The RAAF SMS is not representative of the other Services and accordingly Annex B contains a brief summary of the extant Navy and Army SMSs. Further, a brief comparison of the more visible differences between the three single services is included.

2.3. At the strategic level, the extant RAAF SMS is to conform with the issued OH&S policy and is applied across the organisation. The SMS will by necessity however become increasing program focused as it proceeds from the strategic to the tactical level. In this way the RAAF SMS is in reality comprised of many SMSs to meet the working environment.

2.4. A Commander, regardless of the workplace, must implement a SMS tailored to the needs of the specific program or activity over which he/she has control. The following flow-chart is a pictorial representation of the implementation of the SMS to the Spray Seal Program conducted at 501 WG. What then follows is a detailed examination of those elements that interact with the OC of 501 WG in relation to the implementation of the SMS.

OVERVIEW OF THE IMPLIMENTATION OF THE SMS IN RELATION TO THE SPRAY SEAL PROGRAM FROM THE PERSPECTIVE OF THE OC 501WG



POLICY

2.5. As has been identified earlier in this report OH&S policy is driven from the strategic level within the ADO. In the case of the RAAF it is to be derived from two policy documents. The first being at the head of ADO level, and the second from the single service chiefs.

Australian Defence Organisation

2.6. The Australian Defence Organisation Secretary, Allan Hawke, and Chief of Defence Force Admiral C.A Barrie AO RAN, are the co-sponsors of the ADO Occupational Health and Safety Policy Statement. The aim of the statement is 'to confirm the commitment to safety' and to 'create the foundation on which the structures and systems for safety can be built and continually improved'. The statement, whilst acknowledging the accountability of Commanders/executives imposed by the OH&S Act 1991, outlines the devolution of responsibility for OH&S to all involved (ie Commanders, Supervisors, Subordinates).

The policy statement clearly acknowledges the Defence Safety Management Agency (DSMA) as having primary responsibility for policy, service and expertise with regard to safety.

2.7. There is a stated intent that sufficient resources should be allocated to implement the Policy. The effective management of these resources to achieve a high standard of safety is the responsibility of the Commanders. Commanders also have the responsibility of ensuring that procedures are in place, members are suitably trained and that there is a safety managed committee structure.

Air Force

2.8. The sponsor for this Policy, dated 10th July 2000, is Air Marshall McCormack AO, the current Chief of Air Force (CAF). The Policy aim is to 'confirm the commitment to ensuring the safety of all personnel'. The CAF position is stated as being fully supportive of the provisions of the OH&S Act.

2.9. The Policy stresses the shared responsibility of Command and members (including APS employees) for Safety Management. It identifies the local safety representatives as a point of reference for providing guidance and raising OH&S concerns.

2.10. The Policy confirms that Commanders and Supervisors are to 'actively encourage appropriate safety attitudes' and to be vigilant in hazard identification and removal. However, the Policy Statement does not emphasise compliance and enforcement.

2.11. DSMA is identified as having the 'primary responsibility for workplace safety policy'. The wording here differs significantly from that of the ADO Policy Statement in that it does not refer to DSMA as having a role in providing services and expert advice.

Navy

2.12. The sponsor for this Policy, dated 27th April 2000, is Vice Admiral DJ Shackleton, the Chief of Navy. The aim of the statement is to acknowledge the duty of care the Navy has for its members, APS employees, contractors and visitors and to outline how the Navy intends to discharge this duty.

2.13. The policy recognises the responsibility of Commanders and a collective responsibility of all personnel, in contributing to a safe working environment. The statement recommends the use of ORM (Operational Risk Management) as a measure to balance the competing imperatives of operational capability and safety. This seems to denote a difference in view concerning the interaction between Safety and Operational Readiness as outlined in the ADO statement.

2.14. It promotes a pro-active approach to safety through a no-blame system for the reporting of accidents/incidents. However it is made clear that violation or deliberate non-compliance with lawful instructions will not be tolerated and disciplinary or dismissal action may be taken.

2.15. There is no reference to DSMA, instead it is the Navy Safety Program (NAVSAFE) that is touted as the way in which safety is implemented in the Navy.

Army

2.16. The sponsor for this Policy, dated 27th August 2000, is Lieutenant General Cosgrove, the Chief of Army. The aim of the statement is to acknowledge the duty of care the Army owes its members (including APS employees) and the collective duty of care between Commanders and members.

2.17. It sets out particular safety objectives including the implementation and integration of safety risk management.

2.18. The Policy identifies that injury, illness and incidents are detrimental to the Army's preparedness, acknowledging a positive link between the goals of safety and operational readiness. In this regard it mirrors the ADO Policy Statement.

2.19. The intention to provide appropriate financial resources for the implementation of the Army Safety Management System is listed as an objective.

2.20. As in the ADO Policy Statement, accountability of Commanders is clearly acknowledged with safety management declared as a core function of command.

Support Command Australia

2.21. The sponsor for the Support Command Policy, dated 30th March 2000, is Major General Haddad, Commander Support Australia. The aim of the statement is to express Support Command's commitment to the provision of a safe and healthy workplace. It recognises and supports the achievement of a safe work environment through various means. One such means to this end is listed as being – 'the personal commitment of Commanders and Managers at all levels'.

2.22. Support Command has recently been merged with, and become part of the Defence Materiel Organisation (DMO) and the current standing of this Policy Statement is not clear, although it is understood that there is a draft DMO policy currently pending release.

Tactical Level Policy
501 Wing

2.23. The sponsor of this Policy, dated the 1st of May 1998, is Group Captain Sargeant, the then OC of 501WG. The aim of the Policy is for 501WG to manage and conduct its operations in a manner that eliminates or minimises all hazards to the environment and provides a safe and healthy workplace.

2.24. The Policy states a number of means to achieve this aim, inter alia:

a. to apply EMOHS principles based on the standards-ISO 14001 and AS/NZS 4804;

b. to comply with Federal, State and local EMOHS laws;

c. to identify, prioritise and control activities impacting upon EMOHS; and

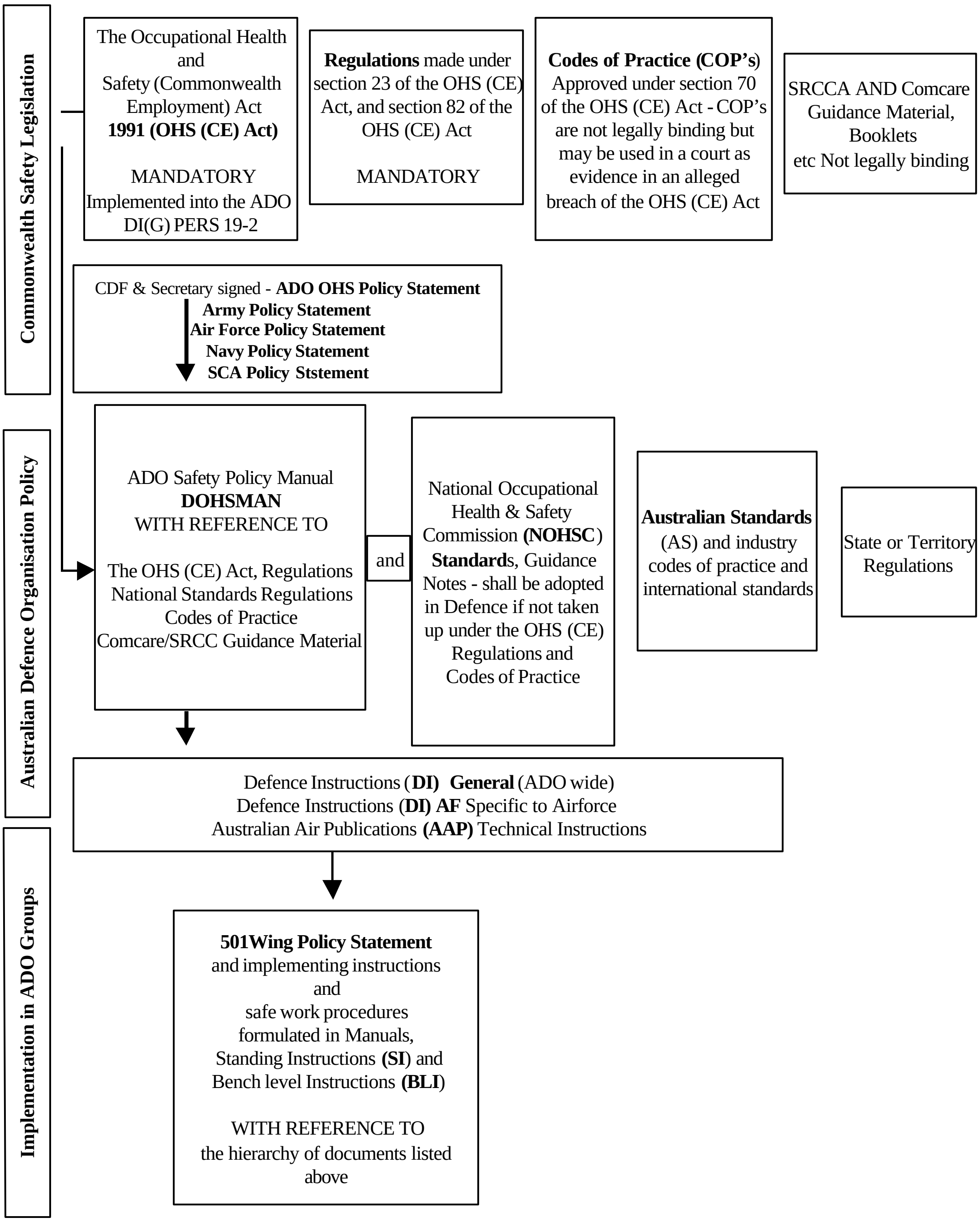
d. to ensure 501WG employees possess the necessary skills and appropriate training to meet their EMOHS responsibilities.

REGULATORY FRAMEWORK

2.25. Commanders have a significant amount of policy instruction and guidance in respect of their responsibilities within the ADO's SMS. Within the regulatory framework that governs the ADO SMS, Commanders are identified as not only having the legal responsibility in respect of the occupational health and safety of their workforce, but also the operational obligation to ensure that best practice is being undertaken.

2.26. The following wire diagram provides an overview of the current regulatory framework.

REGULATORY FRAMEWORK FOR THE SAFETY MANAGEMENT SYSTEM IN THE AUSTRALIAN DEFENCE ORGANISATION



2.27. Occupational Health and Safety (Commonwealth Employment) Act 1991

2.28. The governing law is contained in the Occupational Health and Safety (Commonwealth Employment) Act 1991 (the OH&S Act). It is the primary occupational health and safety legislation at the highest level within the Commonwealth[1]. Under the OH&S Act, the employer has a general duty to take all reasonably practicable steps to protect the health and safety of employees[2]. For the purposes of the OH&S Act, the Secretary of Defence and the CDF are considered Employers and the ADO is therefore bound by the provisions of the Act. An employer must take all reasonable steps to protect the health and safety at work of the employers employees. Commanders, managers and supervisors are responsible for the safety and welfare of their personnel. Inherent in this responsibility is the requirement for:

a. Commanders, managers and supervisors at all levels to be informed of relevant OH&S issues in order to safeguard those personnel over whom they have control;

b. All personnel to be kept informed of OH&S matters to enable them to identify and avoid risks and hazards; and

c. Providing an environment, which ensures that support operations and base administration occurs with the minimum exposure to risks and hazards. The objects of the OH&S Act set out in section 3 are:

(1). to secure the health, safety and welfare at work of employees of the Commonwealth and of Commonwealth authorities; and

(2). to protect persons at or near workplaces from risks to health and safety arising out of the activities of such employees at work;

(3). to ensure that expert advice is available on occupational health and safety matters affecting employers, employees and contractors;

(4). to promote an occupational environment for such employees at work that is adapted to their needs relating to health and safety; and

(5). to foster a co-operative consultative relationship between employers and employees on the health, safety and welfare of such employees at work.

2.29. In formulating an effective SMS the ADO must have regard to the objectives of the Act. The Chief of the Defence Force is required to take into account the need to promote the objectives of the OH&S Act to the greatest extent consistent with the maintenance of Australia's defence[3].

2.30. The Chief of the Defence Force may however declare, after consultation with the Minister, that specified provisions of the OH&S Act ‘do not apply, or apply subject to such modifications and adaptations as a set out in the declaration, in relation to a specified member of the Defence Force, or members of the Defence Force, or members of the Defence Force included in a specified class of such members, and such declaration has effect

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1 The substantive provisions of the OH&S Act came into force on the 6th of September 1991. Two regulations have been made under the OH&S Act, the first in 1991(Occupational Health and Safety (CTH) Regulations 1991), and the second in 1994 (Occupational Health and Safety (CWTH Employment) (National Standards) Regulations 1994.).

2 Section 16 of the Occupational Health and Safety (Commonwealth Employment) Act 1991.

3 Section 7(3) of the Occupational Health and Safety (Commonwealth Employment) Act 1991.

accordingly.' [4] The Chief of the Defence Force has made two declarations under section 7 (2) of the OH&S Act [5].

2.31. The first declaration states that sections 24 to 38 inclusive of the OH&S Act apply in relation to all members of the Australian Defence Force subject to the modification that references to employees in those sections will not include members of the Australian Defence Force. Sections 24 to 38 of the OH&S Act relate to health and safety representatives, health and safety committees, and emergency procedures.

2.32. The second declaration states that section 68 of the OH&S Act does not apply in relation to those members of the Australian Defence Force involved in Australian Defence Force operational deployments, Australian Defence Force deployments in support of the United Nations, or organised sporting activities. Section 68 of the OH&S Act relates to notification and reporting of the accidents and dangerous occurrences to the Commission. This exemption is not applicable to the programs that are the subject of this Inquiry.

2.33. There is currently before the Parliament, a Bill that when passed will make substantial amendments to the OH&S Act including the imposition of custodial sanctions for certain breaches [6]. Should the Bill be passed in its current form, then Commanders who fail to meet their OH&S obligations may find themselves being prosecuted under the Act. Details of the Amendment Bill are provided at Attachment A to Chapter 12. In contrast to this, there is discussion in the Tanzer Report on the review of the Military Compensation Scheme that puts forward the argument that even the current OH&S Act is not fully appropriate for Defence.

2.34. The discussion in the Tanzer Report concerns the appropriateness of the ADF being subject to the provisions of the OH&S Act. The ADF considers that there are weaknesses in the application of the Act to the ADF and associated difficulties with regard to its implementation within Defence. A major concern is that the Act is drafted from a general Commonwealth employment and civil industry perspective. Thus it is said to focus on compliance and regulation without giving sufficient consideration to the special needs of the military environment. In this way the Act is argued to be 'overly prescriptive' and 'administratively cumbersome' and therefore generally unsuitable for the ADF [7]. While it is not denied that, in general terms, the daily operations of ADF personnel (during peace-time) should be subject to OH&S standards, such standards do have to be applied with full appreciation of the 'raison d'etre' of Defence. That is, the core business of the Defence is to train for, and undertake activities (military operations) which have inherently high risks. Operational Capability in this sense forms the clear priority of the organisation. [8] Therefore any OH&S regime which does not fully take account of this, will be dissonant in the military environment. An OH&S system which, in terms of meeting Defence objectives, proves unsuitable or simply unworkable must be seen to have limited value with regard to achieving safety within Defence workplaces.

Regulations under the OH&S Act

2.35. Section 82 of the OH&S Act gives the Governor-General power to make regulations that are required or permitted by the OH&S Act to be prescribed or which are necessary or convenient to be prescribed giving effect to the OH&S Act.

2.36. Section 23 of the OH&S Act provides the specific power allowing regulations to be made relating to any matter affecting, or likely to affect, the occupational health and safety of employees, contractors or other persons, at or near a workplace.

4 Section 7(2) of the Occupational Health and Safety (Commonwealth Employment) Act 1991.
5 The first declaration was made on the 03 Dec 91, and the second, on 10 Apr 95.
6 The Occupational Health and Safety(CTH EMPLOYMENT) Amendment Bill 2000.
7 The Review the Military Compensation Scheme. Department of Defence at page 40. Mar 99.
8 The Review the Military Compensation Scheme. Department of Defence at page 40. Mar 99.

2.37. Two regulations have been made under the OH&S Act. The first regulation is the Occupational Health and Safety (Commonwealth Employment) Regulations 1991 (1991 Regulation). The second was the Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations 1994 (1994 Regulation).

CODES OF PRACTICE

2.38. Section 70 of the OH&S Act grants the Minister power to approve Codes of Practice prepared by the National Occupational Health and Safety Commission. An approved code of practice gives the Commander a practical guide to achieving the standard of health and safety required by the OH&S Act 1991 and Regulations for a particular area of work. An approved code of practice should be followed, unless there is an alternative course of action, which achieves the same, or a better standard of health and safety in the workplace. An approved code of practice is designed to be used in conjunction with the Act and Regulations but does not have the same legal force. A person or organisation cannot be prosecuted for failing to comply with an approved code of practice. However, in proceedings under the Act or Regulations, failure to observe a relevant approved code of practice can be used as evidence that a person or organisation has contravened or failed to comply with the provisions of the Act or Regulations.

2.39. The Approved Codes of Practice (ACOP) consist of the various Australian and New Zealand Standards and NOHSC Standards, concerning specific areas, which have been given statutory recognition. Set out hereunder are Codes of Practice applicable to the Spray Seal Program:

a. Approved Code of Practice on Indoor Air Quality (16 September 1992)

b. Australian/New Zealand Standard - Air Handling and Water Systems of Buildings – Microbial-Control
Part 1: Design, installation and commissioning (AS/NZS 3666.1) 1995 as amended
Part 2: Operation and maintenance (AS/NZS 3666.2) 1995 as amended.

c. Australian Standard - The Use of Mechanical Ventilation and Air-conditioning in Buildings
Part 2: Mechanical Ventilation for Acceptable Indoor-air Quality (AS 1668.2) 1991 as amended.

d. Approved Code of Practice for Workplace Injury and Disease Recording (28 July 1993)

e. Joint Australian Standard (AS 1885.1) 1990, and National Standard [NOHSC:NS 002 (1990)] for Workplace Injury and Disease Recording

f. Approved Code of Practice on Confined Spaces (13 December 1995)

g. Joint National Standard for Safe Working in a Confined Space [NOHSC 1009 (1994)] and AS 2865-1995.

h. Approved Code of Practice on the Control of Workplace Hazardous Substances (13 December 1995)

i. National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC:2007 (1994)]

j. National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011 (1994)]

k. National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012 (1994)]

l. National Occupational Health and Safety Commission Standards

2.40. The National Occupational Health and Safety Commission (NOHSC) has the power to declare National OH&S Standards and Codes of Practice. These are developed as the basis for nationally consistent OH&S Regulations and Codes of Practice but they are not legally enforceable unless governments adopt them as regulations or codes of practice under their principal OH&S Acts[9]. There are a number of NOHSC Standards that have been used by the ADO. Those relevant to the spray seal program include:

a. National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC:2007 (1994)]

b. National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011 (1994)]

c. National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012 1994)]

d. Joint National Standard for Safe Working in a Confined Space [NOHSC 1009 (1994)] and AS -2865-1995.

e. Joint Australian Standard (AS 1885.1) 1990, and National Standard [NOHSC:NS 002 (1990)] for Workplace Injury and Disease Recording.

Australian Standards

2.41. A Standard is a published document which sets out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently performs the way it was intended to. Standards are vehicles of communication for producers and users. They establish a common language, which defines quality and sets safety criteria. There are currently around 6000 Australian Standards, maintained by 1700 separate technical committees, involving nearly 9000 individual committee members[10].

2.42. Australian Standards are not mandatory, unless endorsed in Commonwealth and/or States Acts/Regulations. In the ADO, the use of Australian Standards, binding or otherwise, are encouraged as they can assist the Commander in identifying technical procedures and setting standards against which performance may be assessed.

2.43. Currently there are a number of Australian Standards that may be utilised to implement a SMS, these include:

a. AS4804

b. AS4801

c. AS1401

d. AS4360

e. AS2865

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9 National Occupational Health and Safety Commission http://ww.nOH&Sc.gov.au/work/regulatory/regulatoryframework.htm.

10 Standards Australia at http://www.standards.com.au/.

Defence Occupational Health And Safety Manual

2.44. The Defence Occupational Health and Safety Manual (DOHSMAN), published on the 8th of September 1998, is the current manual implementing Defence's occupational health and safety obligations[11]. However, a number of parts of the previous Occupational Health and Safety Manual (OHSMAN) remain extant[12].

2.45. DOHSMAN was produced prior to the establishment of DSMA and hence tasks Head Defence Personnel Executive (HDPE) with the responsibility of developing and promulgating OH&S policy. HDPE is the sponsor for the DOHSMAN. The DOHSMAN contains policies that have been developed in consultation with the Defence Programs and involved input from the three Services and unions (representing civilian employees). Most of the content of the Manual is derived from the provisions of the OH&S Act, Regulations, Approved Codes of Practice and Safety Rehabilitation and Compensation Commission Approved Guidance Material. The manual identifies that its content is the minimum standard for OH&S management in Defence.

2.46. Commanders, managers, supervisors, members and APS employees, at all levels, are identified as being responsible for implementing the policies contained in the manual[13]. The foreword of DOHSMAN (endorsed by both Secretary and Chief of the Defence Force) states:

a. 'It is not enough simply to comply with the legislation. It is a fundamental element of leadership that Managers and Commanders look after the well being of their people.

b. It is thus vital that Commanders and Managers actively seek ways in which to prevent workplace-related injuries and illnesses. An active approach to Occupational Health and Safety will, not only help to minimise the human cost of such events, but also the associated financial and administrative ones. Importantly, the minimisation of such losses will also make a significant contribution to the maintenance of combat capability.

c. We therefore will hold Commanders and Managers responsible and accountable for the accidents and illnesses, which occur, in their workplaces. It is an inherent part of service in the ADO that we accept managed risks in the conduct of operations. However, this inherent part of military service imposes on all of us an especial duty of care in peacetime to do everything we can to prevent injuries and illnesses through accidents.'

2.47. The DOHSMAN further states that an important function of the Workplace Health & Safety Committees is to 'provide assistance to Managers/Commanders in developing and implementing strategies and actions designed to protect the health and safety of employees'. Annex A to Chapter 5 of the DOHSMAN provides:

a. 'To ensure the effective implementation of this policy/instruction, Program Managers are to provide Commanders/Managers with the appropriate resources.'

2.48. It should be noted however that the nature and extent of these resources is not detailed within Annex A.

2.49. Annex A also states that in the management of hazardous substances, Commanders & Managers are to ensure that an assessment is made of the risks to health created by all work that involves potential exposure to any hazardous substances. It is further stated that

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11 DOHSMAN is located in Defence Manager's Toolbox: Departmental Collection: Manuals.

12 OHSMAN is located in Defence Manager's Toolbox: Departmental Collection: Manuals. The parts that are still in force are identified under OH&S Manual: OHSMAN1 on page http://dsma.dcb.defence.gov.au/defweb/docs/OH&S/OH&SLibrary/OH&S/index.htm .

13 Introduction to DOHSMAN V.

Commanders/Managers may need to seek the assistance of suitably trained Occupational Health and Safety Advisers/Officers in the conduct of such an assessment.[14]

2.50. The DOSHMAN also reinforces the basic premise under the OH&S Act that Commanders/Managers in charge of a Defence Workplace or establishment, must take all reasonably practicable steps to protect the health and safety of employees and others in that workplace. This is stated as applying especially to the use of hazardous substances at work. Commanders/Managers are also tasked with ensuring that any potentially exposed employee is informed of the nature and severity of hazards and any health, safety or environmental issues associated with the use and disposal of a hazardous substance.

2.51. In accordance with the regulations, the DOHSMAN provides that Commanders are responsible for ensuring that all relevant information on hazardous substances and dangerous goods in their workplace is current and readily available to all employees handling such substances. This requirement is to be met through the maintenance of appropriate registers, meeting specific labelling and packaging requirements and providing Material Safety Data Sheets (MSDS) in the workplace for the attention of employees.

Occupational Health & Safety Manual

2.52. The Occupational Health and Safety Manual (OHSMAN) was published in November 1987 by the Personnel Policy & Industrial Branch, Human Resources. The DOHSMAN Chapter pertaining to OH&S Audit (Chapter 2 – Notification, Reporting, Audits & Investigations) refers to Chapter 27 of the OHSMAN 1 as being relevant and extant.

2.53. This Chapter promotes ‘continuous improvement’ via two types of Audits:

2.54. OH&S management audit - a review of the whole OH&S system [Organisation structure, employee/management attitudes, training, PPE, emergency procedures etc] and its effectiveness and its compliance to the OH&S Act.

2.55. OH&S hazard audit – a specific, identified area is required to undergo an audit to determine any deviation from the approved standards (Procedures, Equipment Maintenance, Training etc).

Defence Instructions

2.56. Defence Instructions are issued by the Chief of Defence Force and the Secretary under section 9 (1) of the Defence Act 1903. Defence Instructions made by The Chief of Defence and the Secretary are known as Defence Instructions (General). They form part of the ADO System of Orders, Instructions and Publications. Such instructions are applicable to the ADF, unless otherwise stated to include civilian workers.

2.57. The power to make service-specific Defence Instructions is extended to the Service Chief of each arm of the Defence Force by section 9 (3) of the Defence Act 1903. These are known, (as the case may be), as Defence Instructions (Navy)/(Army)/(Air Force).

2.58. Defence Instructions (GENERAL) are prescribed in DI (G) ADMIN 01-1 (The System of Defence Instructions). They are issued under the joint authority of the Secretary and the Chief of the Defence Force for the joint administration of ADO. They may include principal policy directives, administrative guidelines and matters of common concern to each Arm of the Defence Force.

2.59. Defence Instructions (Air Force), form the next level in the descending hierarchy of instruction and are prescribed by the Defence Act 1903. DIs (AF) are issued to communicate the CAF’s instructions for command of the RAAF. They may include mandates, prohibitions,

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[14] DOHSMAN, Annex A to Chapter 5, at para 17.

guidance or information. They may be expressed as doctrine, policy, strategy, operations, administration, implementation or procedure.

2.60. Defence Instructions (DI) provide more detailed direction to Commanders on their OH&S responsibilities over a broad spectrum of Defence activities and workplaces. DIs amount to lawful general orders to Commanders and as such, not only is a Commanding Officer bound to follow directives contained therein, he/she could also face prosecution under the Defence Force Discipline Act for a failure to comply with such direction. Some of the more important SM related DIs from a Commanders point of view are set out below.

a. **DI(AF) PERS 60-10** - Air Force Occupational Health And Safety Management Structure And Functions.

(1). This RAAF Instruction is referred to in the Chief of Air Force's Safety Management Policy Statement of 10 July 2000, referred to earlier.

(2). The Chief of Air Force states in the Safety Management Policy Statement, that all personnel are to 'make yourself familiar with the guidelines (that is 60-10) and also know who your local safety representatives are. The local Safety representatives are there to provide you with guidance and you are strongly encouraged to report any safety concerns that you may have'[15].

(3). The stated aim of this DI is to detail the structure and functions necessary for Commanders/Managers at all levels in the Airforce Program, to meet their legal obligations under the OH&S (1991) Act.

(4). This instruction outlines the structure of OH&S management. Paragraph one reiterates the ADO policy statement through its inclusion of the responsibility of Commanders at all levels. It provides contact details for Commanders to seek advice on all OH&S matters. These contacts include DSMA, Training Command, and Headquarters Air Command.

(5). The bulk of the relevant content of this DI is contained in Annex A. The Annex sets out the OH&S structure at Group/Wing/Squadron and Unit levels. This covers the positions and structures, which support the Commander in exercising his OH&S duties. These structures are the functions of Designated Work Groups, Health & Safety Representatives, Safety Improvement Teams and Team Leaders, the EMOHSO and the EMOHSAs. The first listed duty of the EMOHSO (Wing OHSA) is to provide advice to the OC on OH&S matters.

(6). An OHSA's duties includes the coordination of OH&S matters arising within their respective area[16]. An OHSA is appointed by a Commander. The detailed list of OHSA duties, 14 paragraphs, is at Annex B to DI (AF) PERS 60-10. An OHSA should have completed an Air Force OHSA Course following his appointment,[17] and should be a Commissioned Officer[18].

(7). The appointment of a Safety Improvement Team Leader (SITL) is made either by the Commander or through an election by fellow workers (this is only in the case of civilian employees)[19].There is no

[15] Air Force Safety Management Policy Statement 10 July 2000.
[16] DI(AF) PERS 60-10 para 36.
[17] DI(AF)PERS 60-10 Annex B at para 1.
[18] DI(AF) PERS 60-10 Annex A at para 1.
[19] DI(AF) PERS 60-10 at para 3e.

minimum rank for a SITL. The position holder is required to have completed OH&S1 Working Safety Course (formerly OH&S for Supervisors) or OH&S3 Managing Health and Safety in the Workplace Course (formerly OH&S for Managers). It is also considered desirable for a SITL to have completed OH&S2 Hazard Management Course .[20] A detailed list of SITL duties is at Annexure G.

(8). OH&S Committees should be chaired by the Commander. It is the OCs responsibility to make all staff aware of the existence of the Committee and its members. The Committee is to meet at least every three months, and minutes are to be taken and kept for no less than three years.[21] The minutes are to be sent to Occupational Health and Safety Manager at Support Command. The functions of the OH&S Committees which are set out in DI (AF) PERS 60-10 para 1, are to assist the Commander to ensure OH&S Policy is effected.

(9). A Safety Improvement Team (SIT) incorporates all ADF and Australian Public Service personnel working in a single functional work area. [22] A SIT should meet as required but at least quarterly[23].

(10). The RAAF OH&S Management structure is divided into three levels:

b. Group;

c. Wing; and

d. Squadron/Unit.

(1). A Wing OHSA must be appointed and all Wings are to have an OH&S Committee. [24].

(2). The functions and operation of the OH&S Committees is set out in Annexure D to DI(AF) PERS 60-10.

(3). Whilst the Commander promulgates the complete membership positions, Annex A para 26 of DI (AF) PERS 60-10 directs certain positions be included on the Wing OH&S Committee. These are:

(a). the OC of the Wing;

(b). the Wing OHSA and Squadron/Unit OHSA;

(c). SITL's;

(d). Health and Safety Representative (HSR) from the Designated Work Group (DWG) within the Wing (civilian); and

(e). Union/Association representatives.

e. DI (AF) PERS 56-1 Environmental Health Services

f. This DI details the responsibilities for environmental health services within the RAAF. It sets out the responsibilities at various levels, with the Commander

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[20] DI(AF) PERS 60-10 Annex A at para 13
[21] DI(AF) PERS 60-10 at para 3.
[22] DI(AF) PERS 60-10 Annex A at para 5.
[23] DI(AF) PERS 60-10 Annex A at para 17.
[24] DI(AF) PERS 60-10 Annex at para 26.

being responsible at wing/unit level for the health of all personnel under their command. Under this DI, Senior Medical Officers are to provide monthly environmental health status reports to the Commanding Officer.

DI (AF) PERS 60-7 Occupational Health & Ground Safety Audits

g. This Instruction holds that Commanding Officers are to ensure that Occupational Health and Ground Safety (OHGS) Audits are conducted in each area at least annually. The DI provides guidelines for the conducting of OHGS audits.

DI (AF) PERS 60-3 Identification, Reporting & Control of Hazards: Policy & Procedures

h. This DI states that all RAAF Commanding Officers are to be responsible for the identification of hazards in their respective workplaces and that supervisors are to assist the Commander in fulfilling this responsibility.

Standing Instructions

i. Standing Instructions are part of the ADO system of Orders, Instructions and Publications and are the tools by which legislative policy, and higher order instructions are implemented at Wing level and below.

j. Support Command Australia issues Standing Instructions that are binding on 501WG.

k. In the case of 501 WG, the Officer Commanding has issued binding Standing Instructions (SI) to the organisation and in particular to the COs under his command in respect of their OH&S obligations.

Support Command Australia Instruction ADMIN 2-4 dated 10 December 1999.

l. SCAI ADMIN 2-4 requires that Commanders and managers at all levels within Support Command Australia (to which 501WG belongs) be responsible and accountable for ensuring that risk is controlled through formal risk management processes.

501 WG SI(PERS) 60-10-1 Environmental Management And Occupational Health And Safety (EMOHS)

(1). This Instruction is an interpretation of the requirements of both the OH&S (Commonwealth Employment) Act of 1991 and DI(AF) PERS 60-1.

(2). 501 WG SI(PERS) 60-10-1 identifies specific positions with stated responsibilities. The positions with responsibility are:

(a). OC 501 WG;

(b). Commanding Officer;

(c). All Officers, Warrant Officers, Senior NCO’s;

(d). Supervisors; and

(e). All 501 WG Employees.

(3). The specific appointments are:

(a). Wing EMOHSA;

(b). Squadron EMOHSA;

(c). Section OH&S Co-ordinator;

(d). Health and Safety Representative (APS).

(4). The Consultation Groups are:

(a). Wing EMOHS Committee;

(b). Squadron EMOHS meetings.

(c). Positions with Responsibility:

(5). OC 501 WG has specific responsibilities detailed in paragraph 11 of 501WG SI(PERS) 60-10-1. OC 501 WG assumes responsibility for the implementation of the OH&S (Commonwealth Employment) Act 1991 and is to ensure '501WG observes, implements and fulfils its responsibilities under the Act, regulations made under the Act, the Commonwealth Legislation, guidelines…'[25]

(6). The SI provides that the Commanding Officers are to ensure:

(a). a Squadron EMOHSA is appointed;

(b). each workplace has a Safety Co-ordinator appointed;

(c). Squadron safety personnel meet at least quarterly;

(d). that regular assessments of OH&S systems, performances and resources take place;

(e). the training and supervision of employees;

(f). that all incidents are reported and recorded; and to

(g). that regular assessments of OH&S systems, performances and resources transpire, and that all operating procedures are regularly reviewed and amended to reflect current legislative and policy requirements.

The SI also directs that Commanders are to be present at the 501WG EMOHS meetings that are to be held at least quarterly.

2.61. All Officers, Warrant Officers, Senior NCO's are to ensure all health and safety precautions and appropriate work practices are correctly observed by persons within their control, and that those persons under their control have read and understood all relevant health and safety-related orders and instructions including the 501 Wing OH&S Manual[26].

2.62. Supervisors have specific responsibilities which include ensuring persons had adequate and applicable training and to liaise with Wing and Squadron EMOHSA's to ensure risk assessments, safety inspections and audits are carried out[27].

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25 501 WG SI(PERS) 60-10-1 at para 11 subpara a.
26 501 WG SI(PERS) 60-10-1 at para 14.
27 501 WG SI(PERS) 60-10-1 at para 15 subparas b & d.

2.63. All 501 WG employees must be alert to the health and safety of themselves and others[28].

2.64. The specific appointments are:

Wing EMOHSA also referred to as EMOHSO

a. This position has detailed specific duties which include establishing and maintaining an EMOHS system, developing a system for which OH&S audits and inspections are conducted within the Wing and performing management systems audits, and assisting where required with the auditing and OH&S assessments[29]. The Wing EMOHSA is responsible for the overall coordination of EMOHS at 501 Wing[30].

Squadron EMOHSA

b. The EMOHSA is appointed by the CO[31]. The role of the EMOHSA is to advise and report on OH&S matters to the CO and to develop OH&S systems within the squadron. Specifically the SQN EMOHSA is to 'develop and monitor a program for which EMOHS audits are conducted within the Squadron[32].

Section OH&S Co-Ordinators

c. The section OH&S Co-ordinator is to assist the EMOHSA in conducting OH&S audits within the squadron as directed by the CO,[33] whereas the SQN EMOHSA is to develop and monitor the audit program as stated above[34].

Health and Safety Representatives

d. They are selected for each Designated Work Group created for the APS. Their duties are detailed in Annex A para 5 of 501 WG SI(PERS) 60-10-1.

Specific Committees

e. The Wing EMOHS Committee and the Squadron EMOHS Committee are to meet quarterly (EXPAND).

Relevant Standards

2.65. **ISO 14001** – Environmental Management Systems – Specification with Guidance for Use:

This Standard is referred to in 501 WG Policy Statement of 11 May 1998 and relates to environmental matters and environmental performance. This is not within the Terms of Reference of the BOI.

2.66. **AS/NZS 4804** – Occupational Health and Safety Systems – General guidelines on principles, systems and Supporting Techniques:

2.67. This Standard is also referred to in 501 WG Policy Statement of 11 May 1998. The focus of this Standard is the implementation of occupational health and safety management systems (OH&SMS) and their integration with other management systems. There is a focus

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28 501 WG SI(PERS) 60-10-1 at para 16.
29 501 WG SI(PERS) 60-10-1 at para 17 subparas b,i, j.
30 501 WG SI (PERS) 60-10-1 at para 6.
31 501 WG SI(PERS) 60-10-1 at para 13 subpara c.
32 501 WG SI(PERS) 60-10-1 at para 18 subpara e.
33 501 WG SI(PERS) 60-10-1 at para 19 subpara d.
34 501 WG SI(PERS) 60-10-1 at para 18 subpara e.

on continual improvement. 'The emphasis in this Standard is for organisations to develop and implement control actions which wherever possible eliminate hazards or isolate people from the hazard. Where this is not possible, work activity should be planned, and controlled to the extent necessary to prevent injury and ill health' [35].

2.68. **Audit** is defined as 'a systematic examination against defined criteria to determine whether activities and related results conform to planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the organisation's policy and objectives'[36].

SUPPORT STRUCTURES

Strategic Level

DSMA

2.69. The Defence Safety Management Agency (DSMA) is the strategic level organisation within the ADO that has the responsibility for higher level OH&S policy. DSMA 'Formulates and coordinates the development, implementation and review of occupational health and safety policy and initiatives for the Department of Defence and the ADF. Provides a consultation, liaison and advisory service to the Australian Defence Organisation on occupational health and safety issues. Manages Defence Material Safety Data Sheets (MSDS) database and the OH&S module of the DEFCARE system'[37].

2.70. DSMA was established in July 1999 and at its launch, its Director, Glen Tye advised that the new Agency would:

a. continue to provide direct support on safety management to Army and Air Force with out posted Command Safety Managers at ASO6 level in Land Command, Army Training Command, Air Command and RAAF Training Command;

b. improve safety management throughout the ADO;

c. engage with all Groups/programs to enable them to understand and meet their safety responsibilities and add value to their activities;

d. focus on people;

e. develop a deployable OH&S capability;

f. contribute to the implementation of the Tanzer Report recommendations;

g. advance DEFCARE as the ADOs safety management system; and

h. develop strategies to reduce the incidence and cost of workplace injury.[38]

DSMA Mission, Purpose and Strategic Approach

2.71. The stated mission of DSMA is:

a. 'To be the centre of excellence in safety management support to the Australian Defence Organisation, maximising operational capability through the preservation of our workforce'[39].

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35 AS/NZS 4804:1997 at page 5 para 3.
36 AS/NZS 4804:1997 at page 6 para 3.1.
37 http://dsma.dcb.defence.gov.au.
38 MAN.0019.001, Witness Statement of Glen Tye.
39 MAN.0019.001, Witness Statement of Glen Tye.

2.72. In fulfilling this role, DSMA sees itself as leading and coordinating ADO efforts to minimise the incidence and severity of occupational injury or disease[40]. DSMA intends to accomplish these goals by providing expert advice, policy guidance, useable tools and services that enable Defence commanders and executives to manage safety effectively.

Communication and access to DSMA

2.73. DSMA support is available to the Commander by usual means, as well as via a 24 hour, toll free help line and the DSMA web site (http://dsma.dcb.defence.gov.au) which incorporates an OH&S discussion line.

2.74. These communication mediums have recorded the following usage rates[41]:

2.75. 24hr help line – all calls (of substance) are recorded and since August 1999 there has been increasing usage, averaging 200 per month, at three minutes per call (see Annexure 2) ;

2.76. DSMA web-services have been well utilised since launched in August 1999[42], with:

a. over 2.1 million ‘hits’ or screens accessed, and over 1600 pages of information viewed per day,

b. over 45,000 different visits to the site, averaging 78 visits per day,

c. average use of the site is 20 minutes for each visit,

d. the site accessed by over 7,850 different personnel in Defence, with 45% using the site more than once, and

e. the top five services on the DSMA web site are (in order of most used) Chemwatch (used 11,500 times), Workplace Safety Management system, discussion lines, OH&S library, and hazard alerts;

2.77. The OH&S discussion lines have been heavily used with the emphasis being on allowing the OH&S network outside of DSMA to facilitate communication by posting queries and responses.

DEFCARE

2.78. The Defcare Project is described as a ‘Project to deliver the integrated safety management, occupational health and safety, compensation and rehabilitation computer system for the Defence Organisation, as well as compensation and rehabilitation computer systems for the Military Compensation and Rehabilitation Services (MCRS) in the Department of Veterans’ Affairs. The project also provides strategic information support on Defence’s occupational health and safety and compensation performance’[43].

2.79. The Defcare Project is an integral part of the DSMA service. The Defcare Computer System was launched at the same time as DSMA. This was the culmination of three years worth of work involving ADO OH&S staff, the Defcare Project Team, Defence Computer Bureau and Softlaw Corporation (the software developer). The system resulted from an investment by Defence of over $M2.00 in a computer system designed to support the management of safety in the ADO[44]. Commanders and their staff have access to this system via DEFWEB.

[40] MAN.0019.001, Witness Statement of Glen Tye.
[41] MAN.0019.001, Witness Statement of Glen Tye.
[42] Based on DEFCARE web usage statistics for DSMA web site from 6/8/99 – 5/3/01.
[43] MAN.0011.001, Witness Statement of Brendan Sargeant.
[44] MAN.0019.001, Witness Statement of Glen Tye.

2.80. ‘ The Defcare system is rich in functionality and justly deserves the awards it has won’[45].

2.81. The system incorporates:

a. OH&S discussion lines;

b. Comprehensive OH&S reference library including legislation, policies and other useful reference material (both internal and external such as CCH, Standards Australia);

c. Contact details for support and links to useful information services;

d. Chemwatch MSDS and chemical management system (including CD ROM version) ;

e. Workplace Safety Management (an award winning safety management tool);

f. Inspection checklists;

g. Inspection and hazard recording;

h. Risk assessment tool;

i. Action management record;

j. Audit tool;

k. Reports;

l. Electronic Risk Score (Assessment) Calculator;

m. OH&S Incident Reporting System;

n. Injury and incident statistics and ad hoc reports system;

o. Advice on training.

COMCARE

2.82. Comcare Australia, is the workers’ compensation insurer for the Commonwealth. It provides safety, rehabilitation and compensation services to Commonwealth employees, administering both the Safety Rehabilitation and Compensation Act (1988) and the Occupational Health & Safety Act (1991). The stated mission of Comcare is to take a leading role in the reduction of the human and financial costs of workplace injury, to prevent injury and to return injured employees to work[46].

2.83. There is an administrative arrangement between the ADO and Comcare for the reporting of incidents, as required by the OH&S Act. The ADO has made a formal agreement to notify the appropriate Comcare office of ‘notifiable’ incidents, as set down in the Act. A Commander may conduct an internal incident investigation but must advise Comcare of this in order to establish what/if any additional information Comcare requires to be included in the investigation Terms of Reference. Updates on the progress of the investigation are to be provided to Comcare every 28 days until the completion of investigation. The resulting report

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45 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 73.

46 CBR.0031.229. Comcare Australia.

and details of any corrective action taken is to be provided to Comcare at this time. Comcare itself may decide to investigate an incident[47].

2.84. In addition to this function, Comcare offers, under a SRC Commission Preventative Program, assistance to Commonwealth agencies in developing a strategic and systematic approach to the prevention of accidents/injury. The program offers services including data analysis, strategic planning and risk management advice to Senior Managers, line managers, OH&S Committees and OH&S personnel[48].

Tactical Level Support Structures
Environmental Health Services

2.85. Environmental Health Services, a division of RAAF Health Services has the responsibility of providing advice in the area of occupational health, including the evaluation and control of physical, chemical and other hazards in the work environment and the medical aspects of ground safety[49]. The prioritisation of Health Services tasks with regard to resource allocation, lists Environmental Health and OH&S as fourth, behind such matters as Aviation Medicine, Flying Safety etc[50].

2.86. Specific responsibilities include:

a. The development and dissemination of Health Services Policy and the provision of specialist advice and assistance to Command HQ and all RAAF units (according to the 501WG EMOHSA this includes the responsibility for the approval and assessment of PPE and Hazardous Chemicals)[51].

b. The CENVHO (Command Environmental Health Officer is responsible to the PMO (Principle Medical Officer) for the provision of such specialist advice to the bases and units.

c. SMOs (Senior Medical Officers) are to advise COs of all environmental health deficiencies identified and are to provide monthly Environmental Health Status reports (for COs and PMO)[52].

Medical services

2.87. Medical Health Flights do not have specific OH&S responsibilities apart from the requirement to conduct annual Occupational Health Assessments on personnel. Medical Officers did not necessarily have OH&S qualifications[53].

TRAINING

Strategic Level Training
Training Hierarchy and Responsibilities

2.88. The Chief of Air Force has delegated training responsibilities within the RAAF to the Director-General of Career Management (DGCM (AF), the Air Commander Australia (ACAUST) and the Commander Training Command (COMTRG-AF). Sponsors of officer specialisations, airman/woman musterings and specialist work groups establish training requirements.[54].

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47 RUS.0019.372. Defence Organisation – Comcare Administrative Arrangement.
48 http://www.comcare.gov.au/prevent.htm.
49 DI (AF) PERS 51-1 The Function, Objectives and Roles of the Health Services, Issue No. 4/89, at page 3.
50 DI (AF) PERS 51-1 The Function, Objectives and Roles of the Health Services, Issue No. 4/89, at page 5.
51 MAN.0007.001, Witness Statement of Hal Waddington, at paras 83-86.
52 DI (AF) PERS 56-1 Environmental Health Services, Issue No. 5/89.
53 EXP.0001.001501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report. WGCDR J Ross. Apr 00.
54 DI(AF) PERS 33-1: 26 Oct 99.

2.89. The DGCM (AF) is responsible for developing the broad policy and plans that connect personnel management with the panelling of training courses[55].

2.90. The ACAUST develops RAAF policy on the conduct of operational and collective training. This means, training individuals to operate as one group, team flight, section or crew, and in the application of a weapon system[56]. Their other responsibilities include, approving Training Specifications for air and ground training, for conducting collective and individual training to meet the requirements of forces, (which includes determining the flying effort required)[57].

2.91. Command Support Australia (COMSPTAS) stipulates and approves training specifications for the logistics systems[58].

2.92. COMTRG-AF promulgates RAAF policy and procedures for the analysis, design, development, conduct, evaluation and management of individual training. Individual training aims to develop training for the purpose of enhancing the skills, knowledge and /or attitudes of the individual[59]. COMTRG-AF approve Training Specifications and they conduct training for induction, initial qualification and selection of postgraduate courses for air and ground individual training. The aim is to support a RAAF-wide system for the certification of individual instructor competence, for maintaining registration of all RAAF Training Specifications, and for issuing the RAAF Schedule of Training. The responsibility also entails specialist training advisory services to Force Element Groups and Commanders of RAAF units with training responsibilities[60].

2.93. Training Command relays the Training Specifications as a guide for the Commanders of units that have the responsibility for the conduct of formal training courses, to further develop, approve, implement and evaluate their curricula. The respective commanders may delegate this responsibility to lower ranks in the units, however, the authority for these training functions still rests with the respective command directives and instructions, and are recorded in the applicable Training Specifications[61].

OH&S Training Syllabus in Defence

2.94. The ADO Occupational Health and Safety Policy Statement, clearly states that personnel with specific responsibilities pertaining to OH&S will be provided with appropriate training to prepare them for their responsibilities in accordance with the OH&S Act. It stipulates that all personnel are to have instructions explaining the objectives and requirements of the Act and that safe operator training is provided for all equipment used by the personnel in the performance of their duties[62].

2.95. The Defence OH&S Committee system is designed in view of providing a dispute resolution channel from the Workplace OH&S Committee to the OH&S policy formulation level, which is DOHSC. The Workplace Health and Safety Committees are to assist management with developing and implementing measures to protect the health and safety of employees. They assist management to review the efficiency and effectiveness of these measures.

Tactical Level Training
Training of Health and Safety Representatives

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55 DI(AF) PERS 33-1 Section 7a: 26 Oct 99.
56 DI(AF) PERS 33-1 Section 3&5: 26 Oct 99.
57 DI(AF) PERS 33-1 Section 7b: 26 Oct 99.
58 DI(AF) PERS 33-1 Section 7c: 26 Oct 99.
59 DI(AF) PERS 33-1 Section 4: 26 Oct 99.
60 DI(AF) PERS 33-1 Section 7d: 26 Oct 99.
61 DI(AF) PERS 33-1 Section 8: 26 Oct 99.
62 Defence Organisation Occupational Health and Safety Reference Book, at page 2: Oct 95.

2.96. The relevant Program Manager is to provide for the course fees associated with the training of Health and Safety Representatives at a course accredited by (COMCARE). Program Managers are also responsible for providing appropriate training to all employees on occupational health and safety and for ensuring expert advice is available regarding the management of health and safety issues.

2.97. Formerly, the Surgeon General Australian Defence Force (SGADF) was accountable to the CDF for the formulation and promulgation of OH&S policy, and to define statements of tasks for training at specified levels of employment, supervision and management in the ADF[63]. Each program was to ensure the development and implementation of the Training Management Plan for those levels. These responsibilities have been transferred to DSMA.

DSMA and OH&S Training

2.98. Since its establishment in 1999, DSMA has produced a number of publications relating to training. It is responsible for managing the following OH&S training courses and reference manuals:

a. OH&S Induction;

b. Occupational Health & Safety Advisers Reference Manual and Participant's Workbook;

c. Managing Health & Safety (1 day course);

d. Workplace Safety Management (3 day course);

e. Advanced OH&S Management (10 day course);

f. RAAF OH&S Adviser course.

AUDIT & REVIEW

Incident Reporting

Introduction

2.99. Incident reporting is one means by which monitoring of the Safety Management System in the RAAF may be conducted. It acts as an upward conduit for information, from 'shop-floor' to management level, enabling pro-active decision making in respect to the Safety Management System. Incident Reports identify hazards and alert appropriate organisations and personnel of risks or problems. The process also provides records from which the relative success or short-fallings of the Safety Management System may be derived. As an important tool within the Safety Management System, the implementation and effectiveness of the incident reporting process warrants examination.

2.100. Central to the system of incident reporting are the following reporting forms:

a. New form for incident reports – Now AC563 instead of AC444; and

b. Hazard Report Form OA79.

2.101. Upon occurrence of an occupational health and safety incident, the unit, for example 501WG, should complete a form, AC563, an Incident and Fatality Report ('the AC563 form').

63 Defence Organisation Occupational Health and Safety Reference Book: Oct 95.

2.102. The AC563 forms are available on the DSMA web-site and can be down loaded. At this stage, it is not possible to directly e-mail the AC563 form to the DSMA upon completion. It is necessary to forward the form, by mail to DSMA.

2.103. The AC563 form has been modified. It was previously about four pages long, but the current version, is only two pages long. It was thought that compliance might be improved with a less lengthy and complex form.

2.104. Three people should be involved in completing the AC563, the person involved in the incident, the person's Supervisor and the relevant Commander, prior to dispatch to the DSMA.

2.105. The Supervisor is required (question 9 of the AC563) to state their comments or proposed action to prevent a similar incident. Similarly, the Commander is required (question 17) to comment on proposed remedial actions to prevent similar incidents. On completion of the form, it is likely that the form will be mailed to the DSMA by the Unit Administration.

2.106. The front cover of the AC563 gives instructions on completion of the form and on forwarding copies of the form to the DSMA and Comcare. The AC563 is to be forwarded to the DSMA and Comcare if it is a serious injury (a dangerous occurrence, incapacity, serious personal injury or fatality). If it is a minor injury, then the form need only be forwarded to the DSMA. All AC563 forms, for both serious and minor injuries, are to be forwarded to the DSMA within 28 days of the Supervisor becoming aware of the incident.

2.107. On arrival at the DSMA, a DSMA officer reviews the AC563 forms. If the forms are properly completed they are entered onto the DSMA database. There are approximately two full-time DSMA officers entering the AC563 forms into the database. The AC563 forms are then entered onto the Defcare Incident Database. A log in ID is required to access this database. However, the results from this database can be viewed on the DSMA web-site.

Strategic Level
OH&S Act 1991 And OH&S Regulations

2.108. OH&S ACT – The Act makes provision for the reporting of certain types of incidents in Part 5 as follows:

a. Section 68 - Notification and reporting of accidents and dangerous occurrences.

b. Section 69 - Records of accidents and dangerous occurrences to be kept.

c. OH&S Regulations - The Regulations provide for the following:

(1). Notice of accidents and dangerous occurrences must be provided to Comcare Australia. The relevant provisions are contained in Regulations 37A, 37B, 37D, 37E and 37F;

(2). Reg. 37B outlines the details required to be included on the form of notification. Similarly Reg 37E includes the details required to be included in an accident report. The Regulation States that an employer must retain a record of a report/notification for a period of 30 years; and

(3). The Regulations make reference to a standard Comcare notification form which ‘may be issued’.

DOHSMAN

2.109. DOHSMAN Chapter 2, covers Notification, Reporting, Audits and Investigations. This Chapter of the DOHSMAN contains Defence Policy on the notification and/or reporting of workplace accidents/incidents and the conduct of related investigations. More detailed direction for the Commander is provided in the following annexes:

a. Annex A – Notification and Reporting of accidents and incidents is set down as a requirement under the Act and associated regulations. This is the only information provided at this Annex.

b. Annex C – It is acknowledged that accidents and incidents generally indicate a weakness in systems, procedures or training and should be investigated to determine the causes and the subsequent action necessary to prevent re-occurrence. This Annex states that the level of investigation to be undertaken should be determined by the circumstances of the accident and the severity of the consequences. This is not elaborated upon. No prescriptive terms are outlined as to the forms to be used to report an incident, how to conduct an investigation or who is to conduct such an investigation etc. It references AS 1885.1 as being a relevant standard.

Relevant Australian Standards

2.110. AS 1885.1-1990 - Measurement Of Occupational Health And Safety Performance - Describing and reporting occupational injuries and disease (known as the National Standard for Workplace Injury and Disease Recording)

2.111. This standard deals with the recording of workplace injury and disease, and is intended for use by both large and small organisations. It includes definitions as well as an explanation of the data items, which are required to be recorded. A section dealing with interpretation and analysis of the recorded information is included. The data includes incidence rate, frequency rate, and average time lost rate, as well as time series analysis and cross tabulations.

Relevant Defence Instructions

2.112. DI (G) PERS 19-2 [DI (AF) PERS 60-1] – Occupational Health & Safety (Commonwealth Employment) Act 1991 Implementation within the Australian Defence Force.

2.113. Under the direction of the DI, and in accordance with the Act, a Commander must ensure that incidents in his/her workplace resulting in death, serious personal injury, incapacity and dangerous occurrences are reported to the Commission for the Safety, Rehabilitation and Compensation of Commonwealth Employees (Comcare).

2.114. Commanders are required to maintain a record of each reported incident for a period specified by the Regulations (the exact period is not stated here but is listed as 30 years under the regulations).

2.115. The OH&S policy of the ADO, OH&S initiatives taken during that year, statistics of accidents/incidents and details of the resultant investigations will be included in the annual Defence Report. Commanders contribute to this report through their chain of command by reporting on the following within their specific command:

a. The selection and number of HSRs (Health and Safety Representatives) selected.

b. The establishment and number of workplace Health & Safety Committees.

c. Measures taken throughout the year to ensure and improve the OH&S of personnel.

d. Statistics of accidents/dangerous occurrences.

e. Details of any investigations conducted during the year.

f. Details of testing conducted upon plant or substances.

2.116. Comcare is the regulatory agency charged with the responsibility to investigate a workplace in order to ascertain compliance with the Act.

2.117. DI (G) PERS 19-5 [DI (AF) ADMIN 11-2 – Notification of casualties and Dangerous Occurrences in the Defence Organisation.

2.118. This Defence Instruction outlines briefly the requirement for incident reporting via form AC 444. Form, AC 444 has now been replaced by AC 563 via Departmental Personnel Instruction (DPI) No 6/93 – Notification & Reporting of Incidents in the Workplace to Comcare. Used properly this incident report regime will eventually give Commanders access to statistical information through the DSMA web site as described in Chapter 14. This information will enable Commanders to identify areas of risk which in turn will help control mechanisms.

Tactical Level
Relevant SIs/BLIs

2.119. The following is a list of relevant instructions within the regulatory framework for incident reporting:

a. SCAI-6-1 Support Command Australia Occupational Health and Safety, provides a Commander with information in respect to the forms used to record serious injury or incapacitation.

b. 501WG SI (PERS) 60-4-1 Environment & Safety Reporting.

c. The Standing 501WG Instruction summarises legislative requirements to:

(1). Notify Comcare of injury to 501WG members/contractors and members of the public ;

(2). Prepare the Annual Defence OH&S Report to Comcare (compiled by WG EMOHSA); and

(3). Notify Qld government of environmental harm.

d. The SI also outlines the procedures for fatality reporting.

Accident/Incident Investigation procedures

2.120. The SI includes a table to determine the level of ‘investigative effort’ required to be made. The investigative team is to be formed within 24 hours and the investigation is to be completed within 14 days.

501 WG ‘Balanced Scorecard’

2.121. The Balanced Scorecard (BSC) provides managers with the instrumentation they need to navigate future competitive success. The Balanced Scorecard translates an organisation's mission and strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system. The Balanced Scorecard, while retaining an emphasis on achieving financial objectives, also includes the performance drivers of these financial objectives. In this way the scorecard measures organisational performance across a number of balanced perspectives. The BSC enables organisations to track financial results while simultaneously monitoring progress in building the capabilities and acquiring the intangible assets they need for future growth.[64]

a. At 501 WG the 'scorecard' is formulated through considerations such as:

b. Number of EMOHS inspections per month.

c. Number of audits completed per quarter.

d. Training (OH&S1,2,3 HSR, EMOHSAA) undergone.

e. Number of EMOHS incidents.

f. Number of CARs (Corrective Action Requests) issued and those outstanding each month.

2.122. 501WG (PERS) 60-3-1 EMOHS Hazard Identification & Control Register.

2.123. This instruction establishes that hazards must be identified, assessed, controlled, recorded and reported to eliminate/minimise the hazards;

2.124. 12.143. The EMOHS hazard Register must be kept to record the results of hazard identification. The Hazard Register is to be created with specific regard to:

a. accident and incident reports;

b. information contained in MSDS;

c. analysis of processes, buildings, equipment and machinery;

d. manufactures/suppliers recommendations;

e. EMOHS audits; and

f. Contemporary medical and scientific knowledge.

2.125. Commanders and supervisors are tasked with reducing the workplace hazards by eliminating or minimising hazards without introducing new hazards through the implementation of control measures. The ongoing effectiveness of the control measures is to be monitored.

2.126. Team leaders are to ensure that personnel under their supervision are made aware of all identified hazards and the related control measures.

2.127. Personnel working in a hazardous environment or undertaking a hazardous process, must be provided with the appropriate training and be competent in performing these tasks in a safe manner.

Audits

2.128. In addition to the regular routine monitoring carried out as part of the measuring of performance there is a need for audits which enable a deeper and more critical appraisal of

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[64] Source: Kaplan, Robert S., and Norton, David P., The Balanced Scorecard: Translating Strategy into Action (Harvard Business School Press, Boston), 1996, p 2.

all elements of the SMS. An audit is a formalised, documented system designed to determine the efficiency, effectiveness and reliability of an organisation's SMS. Audits should ideally be carried out by an audit team, which would include managers and supervisors. Since knowledge of statutory requirements and other performance standards is needed, some training is essential for members of the audit team[65].

Strategic Level
OH&S ACT (1991) And OH&S Regulations

2.129. There are no express provisions for audits in the OH&S Act or Regulations.

DOHSMAN

2.130. Chapter 2 of DOHSMAN deals with –'Notification, Reporting, Audits and Investigations' and states that the function of an OH&S Audit is to systematically review existing processes to determine their quality and effectiveness. This is so that OH&S management practices can be improved, resources can be better utilised and accidents and incidents can be reduced. DOHSMAN refers to OHSMAN 1, Chapter 27: Policy for an OH&S Audit program, which is still the valid policy for OH&S audits.

2.131. Chapter 27 of OHSMAN promotes 'continuous improvement' via 2 types of Audits:

a. OH&S management audit - a review of the whole OH&S system, [Organisation structure, employee/management attitudes, training, PPE, emergency procedures etc] its effectiveness, and its compliance to the OH&S Act;

b. OH&S hazard audit – a specific, identified area is required to undergo an audit to determine any deviation from the approved standards (Procedures, Equipment Maintenance, Training etc).

These audits are compulsory and Commanders should use these results to assist in the formulation of corrective action plans.

2.132. The costs associated with the introduction and conduct of an OH&S management audit program /OH&S hazard audits are to be borne by the area commissioning the procedures.

2.133. Annex A. sets out the elements of the audit processes which include:

a. Planning;

b. actual audit;

c. reporting ;

d. review; and

e. implementation of corrective action to feedback of results.

2.134. Chapter 27 of the OHSMAN states that 'competent OH&S practitioners with relevant expertise' should conduct an audit. Accordingly a Commander must ensure that he/she has such human resources available to, or within, the Unit. OHSMAN provides guidance on the skill set that would constitute an 'OH&S practitioner'. This list includes, risk management, occupational hygiene, safety engineering, ergonomics, toxicology, occupational health, health promotion/training[66]. Within 501WG the SIs stipulate that such audits are to be performed by

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65 Terry ap Hywel – Safety Management System http://members.aol.com/taphywel/sms.html
66 OCCUPATIONAL HEALTH & SAFETY MANUAL. (1987) Chapter 27, Policy for an Occupational Health and Safety Audit Program, at para 2712-3.

Unit personnel who held titles of OH& S Officer, Health and Safety Representative etc. (reference SI)

2.135. The frequency of conducting Audits is not set down in the Manual, instead it is stated as a duty of the OH&S Committees to decide that its OH&S performance is deficient or that the OH&S system requires an independent review. In such circumstances senior management, an OH&S Committee, OH&S Officer or a HSR may commission an audit. Checklists are provided in order to measure systems and hazards against.

Relevant Standards

2.136. The following is a list of relevant Australian Standards:

a. ISO 14001- Environmental Management Systems;

b. AS/NZS 4804- Occupational Health & Safety Management Systems – General Guidelines on principles, Systems & supporting techniques;

c. AS 3911.3-1992 Guidelines for auditing quality systems - Management of audit programs. This standard provides basic guidelines for managing quality system audit programs. These guidelines can be used to establish and maintain an audit program function when performing quality systems audits in accordance with AS 3911.1 and AS 3911.2. This Standard is identical with and reproduced from ISO 10011-3:1991. Identical with NZS 10011.3:1992 and produced as a Joint Australian/New Zealand Standard. This part of ISO 10011 gives basic guidelines for managing quality systems audit programs. It is applicable to the establishment and maintenance of an audit program management function when performing quality systems audits in accordance with the recommendations given in ISO 10011-1.

Relevant Defence Instructions (DI)

2.137. DI (AF) PERS 60-7 Occupational Health & Ground Safety Audits:

a. The DI states that OCs and COs are to ensure that Occupational Health and Ground Safety Audits are conducted in each area at least annually;

b. The audit coupled with Hazard Reports produced in accordance with DI (AF) PERS 60-3 Identification, Reporting and Control of Hazards – Policy and procedures, constitutes the complete Audit Report, which is to be submitted to the relevant OH&S Committee/s;

c. For high-risk work-areas, a job safety analysis is to be conducted as an integral part of the audit process; and

d. The DI provides guidance to Commanders and their staff on OHGS audits and Job Safety Analysis.

2.138. DI (AF) PERS 60-3 Identification, Reporting & Control of Hazards: Policy & Procedures:

a. All RAAF Commanders are to be responsible for the identification of hazards in their respective workplaces, Supervisors are to assist the Commander in meeting this responsibility.

b. OHGSC (Occupational Health Ground Safety Coordinators) and ENVHOs (Environmental Health Officers) are tasked with actively pursuing hazard identification through OHGS Audits and surveys.

c. Units are required to maintain Hazard Report Registers and are annually required to provide a Hazard Report Summary (as outlined above).

d. Hazard Notification should be registered via Form OA 79.

Strategic Level View

2.139. Although each of the Groups has some form of audit capacity embedded within their individual safety management systems, the same cannot be said at the strategic level. Audit and surveillance are necessary for, not only a complete, but equally important, an effective safety management system across the ADO. DSMA is the only ADO agency the Commander can turn to, that can be said to be a body with overall responsibility for OH&S guidance. The charter of DSMA concentrates on policy, advice and being a centre of excellence in relation to OH&S issues.

Relevant Standing Instructions (SI)

2.140. SCA1 (PERS) 6-1 Support Command Australia Occupational Health And Safety:

a. Paragraph 14 provides that success in achieving OH&S objectives within SCA is to be measured in three ways, one of which is regular (annual as a minimum) self-audits of units (sample assessment sheet is included). Programmed independent audits will be coordinated centrally by SCA staff for all units over a 3-year rolling period.

b. Paragraph 24 states that all Units are to complete the SCA Safety Checklist to benchmark the unit's OH&S management systems and practices, and to identify any areas, which require improvement. The date for this to be done by was set down as September 1999.

c. Unit Safety Audits (minimum of annual basis) by OH&S trained personnel (Occupational Health & Safety Officer, Health & Safety Representative or Unit Safety Coordinator) to identify risks and hazards are to be conducted. Recommendations from self-audits or independent audits are to be implemented and reported to HQ SCA.

2.141. Regular Plant/Equipment inspections are to be undertaken to ensure compliance to safety standards.

501WG SI (ADMIN) 2-13-6 Quality Audits

2.142. The SI makes reference to AS/NZS ISO 9001: 1994 which requires internal quality systems audits.

2.143. Commanders must have conducted external quality audits to ensure compliance to this standard. An Audit report should be produced from both internal and external audit processes. The Quality Coordinator (appointed by management) shall set the audit schedule. The SI does not specify the frequency with which audits should be conducted.

501WG SI (PERS) 60-10-1 EMOHS Responsibilities

2.144. Paragraph 13 states that Commanders are to ensure that regular assessments of OH&S systems, performances and resources transpire, and that all operating procedures are regularly reviewed and amended to reflect current legislative & policy requirements.

2.145. The WING EMOHSA (Environmental Management Occupational Health & Safety Adviser) is tasked with:

a. Developing a system for which OH&S audits are conducted within the wing.

b. Performing management system audits and assist where required with other auditing/OH&S assessment.

c. Squadron EMOHSAs and Section OH&S Coordinators are also tasked with the responsibility of facilitating and assisting with audit processes.

501WG SI (PERS) 60-10-2 EMOHS Management Review

2.146. Management Review is the assessment of active performance of the EMOHS system. The EMOHS Committee advises and makes recommendations for improvements. The EMOHS Steering Committee (meets at 6 month intervals or when recommendations are raised by the Management Committee) has authority to implement these recommendations. These management reviews provide a Commander with essential information concerning the effectiveness or otherwise of the SMS, and therefore should be viewed as an essential administration tool.

2.147. EMOHSAs are charged with:

a. Providing progress details on Audit Schedules and results (both internal and external); and

b. Updating Corrective Action Requests (CARs).

501WG SI (ADMIN) 2-13-6-1 EMOHS Audits/Inspections

Audits are a requirement of ISO 14001, AS/NZS 4804 and OHSMAN 1. EMOHS Internal Audits are intended to fulfil a number of purposes. These include:

c. To determine the effectiveness of the EMOHS system;

d. To determine the conformance of the system to the above standards;

e. To form part of the Management Review process and provide a basis for the concept of continuous improvement; and

f. A compulsory EMOHS Auditor Course which must be undertaken by auditors.

g. 501WG SI (ADMIN) 2-13-6-2 Corrective Action Requests

2.148. This SI states that Corrective Action Requests (CARs) replace OA79 Hazard Report and are the recording and reporting mechanism in response to identified non-conformance.

2.149. All CARs are to be implemented as soon as practical after the notification of non-conformance and before the set response date. A review after the completion of the corrective action is to be conducted by the originator liaising with the auditor to verify the effectiveness of the CAR. EMOHSAs shall monitor CAR registers on a weekly basis to ensure responses are received within nominated response times.

501WG EMOHS Manual

2.150. This manual is authorised by the Commander and states that 501WG is ‘firmly committed to a systematic program of EMOHS audits’. These audits constitute part of

501WG's Management Review process IAW ISO 14000 series and AS 3911. The Manual reflects the Commander's intention in respect of the conduct of audits within the Wing. It provides that only auditors independent of the particular area being audited may perform EMOHS audits. 501WG EMOHSAs and SITLs (Safety Improvement Team Leaders) determine the scheduling and frequency of EMOHS audits.

PROPOSED MANUALS

SafetyMan

2.151. The proposed DSMA Defence Safety Manual (SafetyMan) is intended to be the authoritative document concerning the management of Occupational Health & Safety (OH&S) within the ADO. The provisions therein (derived chiefly from the Occupational Health & Safety (Commonwealth Employees) Act 1991 & Regulations, Approved Codes of Practice, Safety Rehabilitation & Compensation Commission (COMCARE)-Approved Guidance Material, established Defence Policy and Instructions) are to form the minimum standard for OH&S management. It is to be applicable to all personnel in the ADO, civilian and military employees, reservists and cadets[67].

2.152. It is acknowledged that the manual may require substantial amendment in the years immediately following its release and Head Defence Personnel Executive (HDPE) is tasked with the responsibility for developing, promulgating and reviewing OH&S policy through the DSMA[68].

2.153. The Manual is comprised of five volumes.

a. Volume 1 is sponsored by DSMA. –

(1). Part 1 deals with OH&S management in a general context. Chapter 1 begins by outlining the objectives of the OH&S Act and in particular, the implementation of the Act into the ADO. Responsibilities of the CDF, the Secretary of Defence, DSMA, Group Executives, Commanders, Supervisors and employees in this implementation process are laid down. The responsibilities of the relevant members of this list are included in most of the chapters throughout this manual Chapter 2 deals with the Defence Safety Management System and structures with specific regard to the Group Safety Committee structure. The remaining chapters of part 1 cover emergency procedures, OH&S training, hazard/risk management, contractor safety, incident reporting, audit and Comcare.

(2). Part 2 is concerned with ADF Occupational Rehabilitation and Compensation.

(3). Part 3 covers physical hazard management associated with plant, electrical hazards, noise, fire and welding, among others.

(4). Part 4 Radiation Hazard; Part 5 Hazardous Substances; and Part 6 Biological Hazard Management are covered with regard to the ADO as a whole in Volume 1.

(5). Part 7 makes provisions concerning general work environment in twenty-one chapters. Examples of some of the matter covered is as follows:

(a). Working in Confined Spaces

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[67] SafetyMan. Volume 1, page v & Introduction.
[68] SafetyMan. Volume 1, page v & Introduction.

(b). Indoor Air Quality

(c). Laboratory Safety

(d). Personal Protective Equipment

(e). Emergency Procedures

(f). Occupational First Aid

(g). Substance Abuse etc

b. Volume 2 is also sponsored by DSMA, is divided into five parts.

(1) Part 1 provides general guidance on the military work environment specifically regarding OH&S. It covers topics such as prevention of heat-related illness and injury, physical, adventurous and survival training and flying safety.

(2) Part 2 forms the draft Navy Safety Manual.

(3) Part 3 is the draft Army Manual of OH&S.

(4) Part 4 is intended to form the Air Force Ground Safety Manual.

(a) A copy of the current Air Force Safety Management Policy signed by Air Marshal McCormack, the CAF is included. The content of part 2 covers Air Force Safety Management policy and structure. The roles and responsibilities are set out for DSM (AF)[69], Command Safety Manger (AF)[70] and Squadron & Unit Safety Advisors and Coordinators[71].

(b) It sets down the 'extra responsibilities' of the Officer Commanding. The implementation structure includes the positions of Safety Advisors (at base, wing, squadron and unit level), Health & Safety Representatives (HSR). It covers the formation of Designated Work Groups (DWG) and Safety Improvement Teams (SIT)[72] and the function and operation of Safety Committees generally[73].

(c) The remaining annexures deal with topics such as, the management of contractor safety, workplace safety inspections, risk assessment and management, hazard management, incident reporting and investigations, audits, hazardous substances, PPE, Confined Spaces, Safety Training and Manual Handling. Many of these topics are similar to those included in part 7 of Volume 1. Volume 1 deals with many of these topics generally while Volume 2 deals with these matters with specific regard to the particular needs of the Air Force.

(5) Part 5 covers Navy Diving.

c. Volume 3 (yet to be released in draft form) forms the draft Aircraft Accident Manual and lists DSMA as its sponsor.

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69 SafetyMan. Volume 2, Part 4, Chapter 1, Annex B.
70 SafetyMan. Volume 2, Part 4, Chapter 1, Annex B.
71 SafetyMan Volume 2, Part 4, Chapter 2, Annex B.
72 SafetyMan. Volume 2, part 4. Chapter 2, Annex A.
73 SafteyMan. Volume 2, part 4. Chapter 2, Annex D.

d. Volumes 4 and 5 (yet to be released in draft form) are sponsored by the Defence Function Groups and deal with Safety Function Specific matters.

DEMPMAN

2.154. Defence Emergency Procedures Manual – DEMPMAN. It is intended that this manual will be released this year. It calls for a 'comprehensive approach' to emergency management across all ADO [land] based sites. To create a consistent standard across all Defence sites, whether multi site (Establishment/Base) or single site (stand alone Defence occupied Building), the following concept for emergency management is to be adopted on release of the Defence Emergency Management Policy Manual. The manual is designed to form a comprehensive approach across Defence as a whole to mitigate threats, hazards, risk and events. It is intended to be the 'mother document' with regard to emergency procedures. It is anticipated that the DEMPMAN will be referred to by the Safetyman, also currently in draft form.

2.155. The concept is based upon Emergency Management Australia (EMA) principles known as the 'Comprehensive Approach' to emergency management. These principles include Prevention (mitigation), Preparedness, Response and Recover (PPR&R).

2.156. To ensure all hazards are identified, and all stakeholders are involved in the planning process, Defence will adopt the 'All Hazards/All Agencies approach' to emergency management.

2.157. To achieve the objective of reducing any risk to sites, it will be necessary to ensure that all agencies (including but not limited to the Police, Fire Brigade, Ambulance, weather bureau, hospitals, emergency services, electricity, gas, water, fuel and food suppliers) provide input into site emergency management planning processes.

2.158. In accordance with SAFETYMAN a Safety and Emergency Management Committee (SEMC) is to be established to oversight all safety and emergency management issues on multi and single sites. A senior executive is to be identified to chair the SEMC. The person identified for this role will be known as the Executive Safety and Emergency Coordinator (ESEC).

2.159. In accordance with DEMPMAN, an Emergency Planning Committee (EPC) will also be established. The EPC is responsible for all emergency response planning for the site. The EPC is chaired by the Head Emergency Planning Committee (HEPC). The EPC will be responsible for ensuring that a site-specific risk assessment is conducted by Defence Estate (building owners), focussing on OH&S (health & safety issues) and Regional Security (security risk/threats). The result of the assessment will allow the EPC to produce written site-specific emergency response procedures.

2.160. An Emergency Establishment Control Organisation (EECO) will be established to manage emergency responses on a multi site. The Emergency EECO will comprise of staff occupying the following positions:-

a. Emergency Controller (coordinates all support and resources, directs other members of the EECO and controls the actions of staff affected by the emergency);

b. Deputy Emergency Controller (understudies the Emergency Controller and assumes role of Emergency Controller in their absence);

c. Communications Officer (activates the communications plan);

d. Deputy Communication Officer (understudies the Communications Officer and assumes role of Communication Officer in their absence);

e. Media Liaison Officer (activates the media liaison plan);

f. Welfare Officer (activates the welfare plan); and

g. Specialist Liaison Officers (representing functional areas as deemed necessary by the EPC.).

2.161. The EECO responds to the Emergency Coordination Centre (ECC), which is located near the main entrance to the multi site and activates the site specific Establishment Emergency Response Plan (EERP). The EERP is the emergency response plan for the entire site and is to include all buildings, naval vessels, port facilities, airfields, fuel and ammunition storage areas, communication facilities, training areas, accommodation areas including married quarters, warehouses and any other facility within the fenced boundary.

2.162. A Building Emergency Control Organisation (BECO) is to be established in all Defence occupied buildings on multi and single sites.

2.163. The BECO will comprise of staff occupying the following positions:

a. Chief Warden (commands own staff) (controls those people affected) and (coordinates support/resources);

b. Deputy Chief Warden (understudies the Chief Warden and assumes role in their absence);

c. Communications Officer (activates the communications plan);

d. Deputy Communications Officer (understudies the Communications Officer and assumes role in their absence);

e. Floor/Area/Zone Wardens direct staff in their floor/area/zone; and

f. Section Wardens (direct staff in their sections under the control of their Floor/Area/Zone Wardens).

2.164. The BECO responds to the Master Emergency Control Point (MECP). The MECP is usually sited near the main entrance to the building and activates the site specific Building Emergency Response Plan (BERP).

2.165. At multi sites, to ensure an appropriate response to an emergency occurs, DEMPMAN refers to escalation levels of emergency response. These are referred to as Emergency Response Levels (ERL).

CHAPTER 3- COMPARISON OF RAAF CORPORATE SAFETY MANAGEMENT FRAMEWORK WITH OTHER SAFETY MANAGEMENT FRAMEWORKS

INTRODUCTION

2.1. This chapter will provide a strategic level analysis of the extant safety management system (SMS), within the RAAF. It has been identified that although the RAAF has, what may be described as, a SMS, it is incomplete and has significant systemic weaknesses. Notwithstanding these shortcomings the term SMS will be used in this chapter to describe the existing occupational health and safety regime within the RAAF.

2.2. The weaknesses or failings in the extant SMS in the RAAF have arisen for a number of reasons including attempted compliance with the OH&S Act and ADO restructuring during the 1990s. The once almost completely autonomous, single-service entities have evolved into inter-dependant Defence Groups. Accordingly, in order to evaluate the RAAF SMS it is necessary to analyse the system in the context of it being under the umbrella of the ADO SMS. Having said that, in relation to Occupational Health & Safety, the ADO has not yet achieved an integrated 'whole of organisation' SMS[1].

2.3. The SHE Pacific Report states:

> 'It is recognised that Defence is a very complex organisation with the blend of multiple services, uniforms and civilians, broad geographical base and a corporate task that is often construed as being incompatible with safety. Nonetheless, it is this complexity that requires clarity and consistency for efficient operation and assurance of legal compliance.
>
> Modern management theory suggests that the most important method for providing clarity of purpose and consistency of process is to establish a management system. Quality systems have provided this for the manufacturing industry for decades; more recently occupational health and safety management systems have become recognised as a vehicle for controlling and improving safety performance[2]'.

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1 MAN.0011.001 Witness Statement of Brendan Sargeant. at page 6, par 15.
2 Review of the DEFCARE Computer System, February 2001, SHE Pacific at page 78.

Lack of an Over-Arching Safety Management System

2.4. At the strategic level there is currently no over-arching SMS across the ADO.[3] Accordingly issues of effective command and control arise. Without a strategic level SMS then, in respect of the existing SMS, or systems (within various Groups that comprise the ADO), there are difficulties in determining what OH&S documents take precedence over others, which policies should be used by which organisation, and what is the inter-relationship between those policies[4]**.**

2.5. This view is supported by the following statement, which was made in the context of attempting to arrange a senior level OH&S management meeting within RAAF:

> **'**Despite a plethora of Commonwealth and State legislation, Defence Policy, Defence Instructions and publications relating to OH&S, its management requirements are lacking. These requirements are not well documented; some are outdated or even referred to but no longer exist; they are poorly understood and there is a lack of adequate guidance provided to Commanding Officers to enable them to discharge adequately, their responsibilities. Perhaps the most pressing problem is the lack of an overarching framework which not only links the relevant documents, but more importantly, governs what is to be done, by whom and how"[5].

2.6. AIRCDRE Schmidt has stated that '*while at first glance some would argue that an OH&S management framework exists within Defence, [he] would vigorously challenge any such claim*". His assessment of the Defence SMS in 1997 was that it could only be described as a 'laissez faire' management system. This was apparently evident in that it showed 'a total lack of process and intellectual rigour (including transparency and consistency), there was no recognition of specialist competencies and likewise no recognition of expert and accountable authorities'[6].

2.7. Further to this, AVM Weller is '*not confident that the overarching organisational structure of the ADF in respect of OH&S is adequate*' particularly in an area where there is a significant degree of reliance on specialisation and expertise. He thus suggests that '*the complexity and risks involved in these (OH&S) processes, demand management and regulation of an order akin to airworthiness management*'[7]. AVM Weller notes that the HDPE has nominated DSMA as a responsible authority. He believes this to be '*a very significant call for such a highly specialised activity*' and then states that he '*suspects that the OC 501WG would not have much confidence in such a certification at this stage*'[8].

POLICY

2.8. The Departmental Policy for Occupational Health and Safety appears in policy and instruction documents, based on the Commonwealth Occupational Health and Safety (Commonwealth Employees) Act of 1991 and related Regulations, Codes of Practice, Guidelines and Australian Standards)[9]. DSMA is responsible for preparing OH&S departmental policy. Extant OH&S policy is currently contained in the Defence Occupational Health and Safety Manual (DOSHMAN). DOSHMAN is set to be replaced by the SAFETYMAN, which will incorporate all Defence OH&S policy and manuals (including

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3 MAN.0011.001, Witness Statement of Brendan Sargeant. p 6, par 15.
4 Report of Risk Management Australia at Part 4, p1.
5 IOI.0031.006. Minute from WGCDR Roger Preston to various recipients. "OH&S Management Meeting". Aug 00.
6 MAN.0009.001, Witness Statement of Noel Gilbert Schmidt. p 7.
7 IOI.0031.006. Minute from WGCDR Roger Preston to various recipients. "OH&S Management Meeting". Aug 00.
8 IOI.0031.006. Minute from WGCDR Roger Preston to various receivers. "OH&S Management Meeting". Aug 00.
9 MAN.0025.001, Witness Statement of Linda Kaye, p 9 par 36.

DOHSMAN) for the three services Navy, Army and Air Force[10]. Co-existing at present is, a Defence Instruction (DI (AF) PERS 60-10) for Occupational Health and Safety in the Air Force, an Army OH&S Manual and a Navy OH&S Manual[11].

Corporate Safety Management

2.9. For occupational safety in the ADO, responsibility has been delegated by CDF to Head Defence Personnel Executive. Although the Surgeon General Australian Defence Force (SGADF) is assigned responsibility for corporate occupational safety policy in some places[12], the most recent policy assigns this responsibility to the Defence Safety Management Agency (DSMA)[13]. Interestingly, even though occupational safety is about managing the risks to the health of personnel, policy development is now the responsibility of DSMA and not Director General Defence Health Services (DGDHS). It has been suggested that a lack of clear policy, which articulates the ADO and group-level responsibilities in establishing and maintaining an effective SMS, has led to unrealistic expectations being imposed upon DSMA and the Defence Personnel Executive[14].

Governance

2.10. It is understood that a submission on the importance of safety as a governance issue for the ADO will be taken to the Defence Committee (DC) meeting of April/May 2001. The expectation is that the DC will sign up to safety standards and accountabilities that will firmly embed safety into the governance framework for Defence[15].

Prescribed Safety Standards for Defence

2.11. DSMA is currently developing a number of safety standards for acceptance by the Defence Committee. It is proposed that these standards would form part of the governance accountability measures of safety performance between the Defence Committee and the Group Heads. Ultimately it is proposed that Group Heads provide the Defence Committee with a letter of assurance of their Group's compliance to the safety standards[16]. At this early stage of development the draft standards cover the following areas:

a. systematic approach to safety management in accordance with AS4801/4804;

b. incidents are reported and investigated;

c. employees receive appropriate training within prescribed timeframes;

d. consultative arrangements including safety committees;

e. hazard and risk management approach;

f. safety in the design, acquisition and purchasing process;

g. contractor safety management; and

h. safety systems auditing.

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10 MAN.0025.001, Witness Statement of Linda Kaye, p 9 par 37.
11 MAN.0025.001, Witness Statement of Linda Kaye, p 9 par 38.
12 Defence Instruction General Personnel 19-2, op cit, par 60.
13 Australian Defence Organisation Occupational Health and Safety Policy Statement, op cit.
14 IO Report. WGCDR Secker, at page 5-6 par 5.19.
15 MAN.0019.001, Witness Statement of Glen Tye. p19, par 62.
16 MAN.0019.001, Witness Statement of Glen Tye. p23, par 77-79.

2.12. It is proposed that policies and procedures contained in SAFETYMAN will 'cascade' down from and support each of the prescribed standards[17].

2.13. The SHE Pacific Report states:

'It is recommended that the ADF establish a clear set of OHS Standards that describe the safety outcome that they expect to achieve. The standards should be applicable to all services and civilians. In addition, there should be procedures (sometimes called policy in the ADF) which describe how the standards should be achieved. Some procedures will need to be consistent across all of Defence, eg. procedures on incident reporting or on risk assessment, but others may vary between services to reflect their way of doing things'[18].

STRUCTURE

Restructuring of the ADO

2.14. The constant restructuring of the defence force throughout the 1990s has contributed to safety being kept in the background of the reform process[19].

Pre 1996

2.15. With the introduction of the OH&S Act in 1991, the Human Resources and Management Division formed the Directorate of Occupational Health and Safety (DOHS). The DOHS was a civilian organisation charged with managing the relationship with the new regulator (Comcare) and promoting awareness of the new legislation across the Australian Defence Organisation (ADO). This was done in consultation with the Directorate of Defence Force Environmental and Medical Policy (DDFEMP) in the Office of the Surgeon General Australian Defence Force and the three single-service OH&S organisations. DOHS was responsible to the First Assistant Secretary Human Resources and Management (FASHR&M)[20].

2.16. Prior to the Defence Reform Program (DRP) each of the three services was responsible for its own SMS[21]. In the case of RAAF, command and control of its SMS rested with the Environmental Health Section within Headquarters Training Command Health Services Directorate. The structure that supported Environmental Health and Occupational Health Safety systems within Health Services Directorate at the time consisted of:

a. 1 x GPCAPT Medical Officer who had the title of Principal Medical Officer;

b. 1 x WGCDR Dentist;

c. 1 x WGCDR Nurse;

d. 1 x SQNLDR Pharmacist;

e. 2 x FLTLT Environmental Health Officers; and

f. 1 x WOFF Environmental Health Surveyor.

2.17. The Environmental Health Officers were responsible for Occupational Health and Safety issues arising from areas under the command of Headquarters Training Command.

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17 MAN.0019.001, Witness Statement of Glen Tye. p23, par 77-79.
18 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 78
19 MAN.0113.001, Witness Statement of Brett Wood. p 27, par 86.
20 MAN.0019.001, Witness Statement of Glen Tye, p1, par 1.
21 MAN.0025.001, Witness Statement of Linda Kaye. p 8-9, par 33-34.

The Environmental Health Officers reported to the Principal Medical Officer (PMO) and had the support of two Senior NCO Environmental Health Surveyors. At the relevant time, 501 Wing Environmental Health and Occupational Health and Safety Officers reported concerns through this chain[22].

2.18. In 1993, at the direction of the Chiefs of Staff Committee, some resources applied to OHS management in each of the three services, Navy, Army, and Air Force were combined with DOHS and DDFEMP to form the Directorates of Civilian Occupational Health and Safety (DCOHS) and Defence Force Environmental and Occupational Health and Safety (DDFEOHS) in the ADF Health Services organisation responsible to the Surgeon General (SGADF). In 1995 the two Directorates were combined into the Directorate of Defence Occupational Health and Safety (DDOHS), again within the Office of the Surgeon General.[23]

2.19. It is understood that over time this arrangement was perceived by the single services to be unresponsive to their needs and they commenced re-establishing separate OHS organisations within their respective HQs[24].

2.20. This change in policy direction was a difficult period for the Australian Defence Force (ADF). There was a combining of the civilian safety systems with the military safety management systems and the ADF being bound by legislation other than the Defence Act. Section 7 of the OH&S Act indicated that the Chief of the Defence Force (CDF) would do everything in his power to comply with the intent of the OH&S Act, consistent with the Defence of Australia. The new civilian lead, in DDOHS, on safety compliance resulted in the Services having difficulty changing their systems of protection when they felt that they were already complying with section seven of the OH&S Act. With a change in focus from the workers to the executive came a different approach to safety management, policy writing and the implementation of procedures[25].

Post 1996

2.21. Further changes took place at the end of 1996. The effect these changes had on RAAF was that the Health Services Directorate-Headquarters Training Command was disbanded in October 1996 and the roles of the two Environmental Health Officers and the two Senior NCO Environmental Surveyors were combined into the one position of Command Safety Manager – Headquarters Training Command. Not only did the position assume the roles of the four previous positions, but it also was not afforded any support staff[26]. Phillip Blanck had previously held the position of Warrant Officer Environmental Health Surveyor (Headquarters Training Command) and was appointed the inaugural Command Safety Manager – (Air Force). He did not receive a hand-over for the position, as there was no one from which to receive a hand-over. However a duty statement had been prepared for the position. The Command Safety Manager – Headquarters Training Command (CSM-HQTC) was/is primarily responsible for OH&S training of RAAF personnel in units under the Command of Headquarters Training Command. The position also became responsible for the following:

a. Hazardous Substance Management Assessment of any chemicals proposed to be the acquired and used by the RAAF.

b. Confined Space Entry Training.

c. Personnel Protective /Equipment (PPE) – the management of the approved

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22 MAN.0109.001, Witness Statement of Philip Blanck. p3, par 6.
23 MAN.0019.001, Witness Statement of Glen Tye. p 1, par 2.
24 MAN.0019.001, Witness Statement of Glen Tye. p 1, par 2.
25 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 5, par 13.
26 MAN.0109.001, Witness Statement of Philip Blanck. P3, par 7.

list of RAAF PPE.

d. Occupational Health & Safety Audits and Inspections.

e. Liaison with Comcare officials for investigations/audits.[27]

2.22. In July 1998 the resources applied to OHS in both Army HQ and Air Force HQ were transferred to DDOHS. OH&S resources from the Australian Defence Force Academy were also transferred to DDOHS[28].

2.23. In September 1998, at the direction of HDPE, the newly amalgamated DDOHS conducted a conference facilitated by OHS consultants, including all those directly involved in OHS management in Defence. The purpose of the conference was to develop a new approach to the central management of safety in the ADO. The recommendations in the resulting report were not accepted by HDPE[29].

2.24. The Defence Safety Management Agency (DSMA) was established in July 1999 and was staffed in about October 1999. In relation to RAAF the DSMA assumed the responsibility of DDOHS and OHS1AF. Previously DDOHS had reported direct to HDPE and OHSI-AF had reported to CAF. Both positions have been subsumed into DSMA, which reports to HDPE. There was, until the 3rd of April 2001, no position that reported directly to CAF on matters relating to Occupational Health and Safety. DSMA has three staff who are responsible for OH&S in the RAAF: OH&S 1 AF and the two Command Safety Managers – Training Command and Air Command[30].

2.25. SQLDR Paul Beighton, who was an Environmental Health Officer at Amberley states that there is a gap in the implementation of the SMS at the lower levels[31].

> 'Perhaps the DRP has eroded the chain of command and obscured areas of responsibility. The downsizing of uniformed people has meant an increase in primary duties in many instances and secondary duties (such as the safety adviser) become less of a priority because the primary duty requires greater time'[32].

Loss of Corporate Knowledge

2.26. Constant reorganisation of the ADO generally with the flow on effect to the SMS has led to a loss of knowledge in the area of occupational health and safety. For example the DSM (AF) says :

> 'Some of the [OH&S] policies were lost or not transferred in the various changes from place to place'[33]. and

> 'When training was stopped for ENVH personnel in or around 1993, the numbers of safety qualified ENVH personnel dropped from around 17 to around 4 personnel today. The rest of the qualified people have moved on to permanent safety positions outside of Defence'[34].

Defence Occupational Health and Safety Policy Committee (DOHSC)

2.27. The principal civilian occupational health and safety committee at a strategic level is the DOHSC. Members of the DOHSC are Senior Defence Managers and Union officials

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27 MAN.0109.001, Witness Statement of Philip Blanck. P3, par 7.
28 MAN.0019.001, Witness Statement of Glen Tye, p2, par 5.
29 MAN.0019.001, Witness Statement of Glen Tye. p2, par 7.
30 MAN.0109.001, Witness Statement of Phillip Blanck. p 6, par 9.
31 MAN.0028.001, Witness Statement of Paul Beighton dated 18 May 2001. p15, par 38.
32 MAN.0028.001, Witness Statement of Paul Beighton dated 18 May 2001. p15, par 38.
33 MAN.0113.001, Witness Statement of WGCDR William Brett Wood. p 7, par 20.
34 MAN.0113.001, Witness Statement of WGCDR William Brett Wood at p 6 par 17.

nominated by the Defence involved unions. The senior Defence member chairs the DOHSC. Civilian Committee members have the authority to facilitate the implementation of decisions of the Committee. The Committee meets twice a year[35].

Lack of Clear Delineation of Responsibilities.

2.28. The lack of clearly defined roles and responsibilities of various agencies has been identified by a number of witnesses as a contributing factor to a less than effective SMS. In some cases agencies might be seen to have similar or overlapping or ambiguous OH&S roles. An example of this may be found in the fact that the both the Surgeon General (SGADF) and DSMA appear to be assigned some responsibility for Defence OH&S policy.[36]

To this end, CAPT England (RAN) states that:

> 'Despite the guidance and direction that is currently in DI (G) 07-8, DOHSMAN, OHSMAN 1 and AAP 3504.001, there does not appear to be much in the way of accurate, clear and practical guidance addressing the interface between the ADF airworthiness, regulatory procedures and the National OH&S management requirements. This issue is further complicated by the lack of clearly defined and realistic OH&S management responsibilities within the ADF technical, environmental and health organisation. There appears to be no ADF organisation with overall responsibility for the entire OH&S management system'[37].

2.29. Further evidence of a lack of clarity with regard to responsibilities may be found in the following statement:

> 'OC 501WG has identified that the delineation of responsibilities for explosive level monitoring, ventilation and safety distance for fuel tank repair is unclear as both maintenance - Director General Technical Airworthiness (DGTA) and safety – DSMA issues are involved'[38].

2.30. 501WG EMOHSO Hal Waddington states:

> 'that while DI (AF) PERS 60-10 specifies BASE level responsibilities, other ADO program responsibilities, particularly with regard to design and acquisition functions, are not specified by any higher level documentation. This is the explanation given for the lack of organisational definition, of OH&S responsibilities between agencies and their inter-relationships, which is said to exist in the ADO currently'[39].

2.31. In illustration of this point, a brief to CAF (among others) prepared by GPCAPT Sargeant highlights that DSMA advised him that purchasing organisations within Defence were responsible for health and safety issues relating to products that they procured. However, JFLA informed him that they do not have this capacity or capability. A further 'outstanding issue' highlighted in this brief is the matter of who has the responsibility for supporting COs in the management of PPE, maintenance safety and safety solution design[40].

2.32. Confusion concerning OH&S lines of responsibility was the subject of a proposed

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[35] DOHSMAN, Chapter 1, Annex D, E, I.
[36] DI (G) PERS 19-2, op cit, par 60.
[37] AHQ.0001.096 Brief for CAF, ACAUST, SUPTCOM (AF), DGDHS & COMCARE – Logistics Hot Issue Brief Update – 24 Aug 00.
[38] AHQ.0001.096 Brief for CAF, ACAUST, SUPTCOM (AF), DGDHS & COMCARE – Logistics Hot Issue Brief Update – 24 Aug 00.
[39] MAN.0007.001 Witness Statement of Hal Waddington, at page 16 par 61.
[40] AHQ.0001.096. Brief for CAF, ACAUST, SUPTCOM (AF), DGDHS & COMCARE – Logistics Hot Issue Brief Update – 24 Aug 00.

management meeting. Issues to be raised highlighted a number of problems with regard to knowledge of which agencies held responsibility for specific matters of OH&S significance. The areas of confusion concerned:

a. Who is responsible for carrying out an OH&S risk assessment on a process before it is approved and issued in a publication for maintenance units to follow?

b. Where does an engineer or maintenance organisation go to find out information on OH&S issues or seek specialist OH&S advice associated with the introduction of a technical process involving hazardous substances or other OH&S issues?

c. When there are significant OH&S problems, conflicts or new unexplored OH&S issues, who can approve the OH&S measures proposed?

d. Who is responsible for ensuring that new hazardous substances, imported for ADF use direct from overseas, are registered with the Australian OH&S organisations?

e. Who is responsible for monitoring national and international OH&S issues which may be relevant to the ADF and ensuring that the appropriate ADF organisation addresses any changes required to ADF practices?[41]

Support Structures

2.33. Commanders are seen as typically having the capability to execute most aspects of the risk management process, including development and execution of risk treatment plans, at the lower end of the risk continuum. These types of risk might be referred to as ‘slips, trips and falls’ and equate to the types of risks that might be found in an office environment. At the other end of the continuum, employees work in hazardous situations[42] with a high potential to cause harm. Here there are numerous sources of risk to health and the hazards may be severe. At this end of the continuum, the risks require extensive treatment to reduce them to an acceptable, although perhaps still high, level. As the risk increases so does the demand for greater involvement of Commanders and increased competence in risk management, the development of risk treatment plans and the technicalities of the risk being managed[43].

2.34. While there is no doubt that Commanders are and should be responsible for the safety of their personnel, it does not follow that they should develop risk treatment plans or execute them independently of the remainder of the organisation. Clearly, it would be impractical for example, for the ADO to equip each tactical Commander with the medical capability to manage all types of injury to their personnel. Instead Commanders rely on other parts of the organisation for the provision of medical services[44].

2.35. WGCDR Secker states that ‘there are inefficiencies in having Commanders go about fulfilling this responsibility [the safety of maintenance personnel] independently of the remainder of the organisation. They [COs] must rely on other parts of the organisation to fulfil this responsibility if safety is to be efficiently and effectively managed for aircraft maintenance processes. Commanders need to manage safety within a corporate framework

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41 IOI.0031.006. OH&S Management Meeting. 31 Aug 00.

42 Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations 1994, Regulation 10.01, p161 defines Hazard as meaning ‘the potential to cause injury or illness’ and a Hazardous Situation to mean ‘a situation that has potential to cause injury or illness to an individual’.

43 IO Report. WGCDR Secker, at page 5-3 par 5.13.

44 IO Report. WGCDR Secker. at page 5-3, par 5.12.

that defines roles and responsibilities for advising and supporting them'[45].

2.36. However, as WGCDR Secker purports, there is little in the way of policy (excluding the formation of Committees) which deals with the corporate framework and how Commanders at any level are to be provided with OH&S support and advice[46].

2.37. He further states that while general policies exist regarding obtaining ad hoc support, there are no policies that define the nature of the occupational safety relationship between the different parts of the organisation. He also states that this absence of a corporate policy describing Groups' relationships pertaining to occupational safety, is reflective of a simplistic treatment of Defence's corporate management structure[47].

2.38. In support of this, 501WG EMOHSO, Hal Waddington also cites a lack of organisational definition of OH&S responsibilities between agencies and their inter-relationships in the ADO currently[48].

2.39. Considering the necessity for Commanders to rely on other parts of the organisation to provide them with OH&S support and advice, such support agencies and their discreet functions and responsibilities should be made clearly known, visible and accessible to Commanders[49].

2.40. A 'Centre of Expertise' for OH&S management has been raised as a necessary tool for Commanders[50]. Environmental Health Services is primarily focussed on public health and has a range of other responsibilities[51], all of which feature higher on the organisational priority list than OH&S[52]. While DSMA does provide advice, it too is primarily a policy organisation[53]. In this case, it is arguable whether a 'centre of expertise' actually does exist. GPCAPT Sargeant stated in his evidence that 'If I had an OH&S problem, for example, PPE, what we have done in the past is gone to environmental health… and hopefully they may have the expertise…. I certainly don't have what I believe to be a competent accredited agency that I can go to, to seek advice on hazardous substances'[54]… 'There are very limited experts in the organisation'.

2.41. GPCAPT Sargeant also states that when specialist OH&S services were needed, 501Wg resorted to funding external consultants on a number of occasions[55]. It is interesting to note that DSMA does not seem, in the OC's opinion, to qualify as a centre of expertise for advice on such matters as

2.42. PPE, hazardous substance etc. WGCDR Secker holds a similar view. Further, he states that there is justification for the formation of such a centre of expertise[56].

2.43. It has been suggested that appropriate OH&S structures and agencies to assist Commanders in discharging and performing their duty to maintain a safe working environment for employees, are not currently in place within RAAF. GPCAPT Sargeant's recent difficulty in locating, not only the appropriate OH&S bodies for the validation of the

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45 IO Report. WGCDR Secker. at page 5-6, par 5.17.
46 IO Report. WGCDR Secker. at page 5-6, par 5.17.
47 IO Report. WGCDR Secker. at page 5-6, par 5.17.
48 MAN.0007.001 Witness Statement of Hal Waddington. At page 16, par 61.
49 IO Report. WGCDR Secker.at page 5-8, par 5.25.
50 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings: GPCAPT R Sargeant. 28 Feb.01 at page 19.
51 IO Report. WGCDR Secker. at page 5-8, par 5.24.
52 MAN.0010.001 Witness Statement of Carey John Murphy, at page 3, par 13.
53 IO Report. WGCDR Secker. Page 5-8, par 5.24.
54 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings: GPCPT R Sargeant. 28 February 2001. P 23
55 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings: GPCPT R Sargeant. 28 February 2001. P 24
56 IO Report. WGCDR Secker. at page 5-8, par 5.24.

spray seal process, but merely in finding a person/organisation who did know where to find such bodies (outlined above) underscores this contention.

Non-fulfilment of functions within Strategic Agencies

Support Command Australia

2.44. 501WG reports directly to Support Command Australia (SCA). Linda Kaye was the Occupational Health and Safety Officer (OHSO) within SCA at the relevant time. The responsibilities of the OHSO expanded considerably (post DRP), from 30 units (in HQLOGCOMD) to approximately 120 SCA Navy, Army and Air Force units/workplaces (this number was gradually reduced to approximately 100 due to restructuring and the SCA Commercial Support Program). The associated time constraints resulted in the OHSO experiencing difficulties in fulfilling her duty in a number of ways, specifically with respect to auditing SCA units such as 501WG.

> 'At the Director level of management, it was decided in the early stages of SCA in late 1997 that I personally could not comply with initiating/implementing audits across the whole command. This task was in each of my duty statements. Both Kevin McLaren and Bob Elworthy, and later Leonie Haynen said it was impracticable for me to audit all units. They told me I would get no staff or additional resources. This is why we came up with the benchmark audit program and this meant that I would not personally conduct audits, but coordinate and facilitate getting them completed through the Benchmarking Audit Program'[57]**.**

> 'In regard to the audit results, I was waiting to get a dozen or so of them before I reported to the head of Support Command. This, however, did not happen because of the reorganisation involving DMO. Part of the benchmarking audit was for me to report the results to the Commander, to see if there were any patterns and to give a report identifying where the units were at, for example whether there was enough training, or attention to plant'[58].

2.45. Prior to the benchmarking audit program, the OHSO monitored the tactical level OH&S issues via liaison with Unit OH&S personnel and by reading the individual unit OH&S Committee Meeting Minutes[59]. However the situation changed somewhat when the workload for this position increased. Kaye states that when she distributed DSMA information she 'reminded the units to send in their OH&S committee minutes. With the benefit of hindsight these minutes could have been followed up more actively. I do not know why I did not do it'[60].

With regard to her stated duties, Kaye states*:*

> 'My current duty statement came into effect about April 2000 following HR restructuring in SCA. I saw my HQLOGCOMD role as coordinating the detail of the Command's Occupational Health and Safety, I followed up with all unit occupational health and safety staff as required on a daily, weekly or monthly basis but in SCA this regular contact was a luxury that time did not permit and my contact with units became reactionary or upon request'[61]. The focus of my actual duties (within SCA) moved away from giving detailed advice to that of general guidance or clarification due to the expanded number of units within SCA'[62].

Effects of Reorganisation of Structure

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57 MAN.0025.001 Witness Statement of Linda Kaye, at page 4 par 13.
58 MAN.0025.001 Witness Statement of Linda Kaye, at page 6, par 24.
59 MAN.0025.001 Witness Statement of Linda Kaye, at page 7 par 26.
60 MAN.0025.001 Witness Statement of Linda Kaye. at page 7 par 27.
61 MAN.0025.001 Witness Statement of Linda Kaye. at page 8 par 31.
62 MAN.0025.001 Witness Statement of Linda Kaye. at page 8 par 32.

2.46. AVM Weller noted that*:*

> 'Recent ADF restructuring also seems to have reduced the capability of the organisation to provide specialist advice in respect of OH&S'[63].

Linda Kaye states that:

> 'As part of the Defence Review Program, the three separate Logistic Commands were amalgamated to create Support Command Australia. This resulted in a possibility of three staff members (holding APS6- OH&S positions in each service command) competing for one position within the new SCA structure. Eventually, I understand the Navy HQ LOG COMD OH&S position was transferred to Maritime Headquarters in Sydney and the Air Force OH&S position was located in HQ Training Command. Consequently that resulted in my position being transferred into SCA as coordinator for OH&S across the Command (or three different Logistic Commands)'[64].

> 'The SO2 OH&S position duty statements (in HQLOGCOMD and SCA) have changed a couple of times due to restructuring[65]. Following structural changes I have had three different supervisors, over the last twelve months'[66].

2.47. Further comments on the restructuring that occurred in the 1990's:

> 'I think that the changes in the Defence Organisation consequent to the implementation of the Defence Efficiency Program (and Defence Review Program) have had a significant influence on the Departmental Occupational Health and Safety Framework. Prior to DRP (in 1997) each Program (or Departmental Group) had a particular OH&S structure. Each program Headquarters had staff and support staff in lower level commands/units who worked full time on OH&S. I thought that SCA would establish a similar framework however as stated above (in paragraph 10) only one position was transferred to SCA from the merging three service Logistic Commands with no additional resources allocated. In the HQ to co-ordinate OH&S for the whole of SCA, Support Command had initially about 10,000 staff but this has dropped to about 8,000 due to restructuring mentioned previously'[67].

> 'Mr Waddington and 501 Wing were previously under the RAAF program and would report along the RAAF chain of command to a RAAF supervisor/manager as well as being able to liaise with the RAAF Safety Officer, WGCDR Brett Wood. Upon the creation of SCA he also liaised with me at HQSCA because 501 Wing was in SCA Air Force. Technically, 501 Wing should have come through the chain of command to me for OH&S issues. Generally, this was not enforced. However, I had no supervisory control over him but liaised and discussed safety issues with him''[68].

It has been purported that the lines of OH&S reporting have been blurred as a result of the numerous structural reorganisations.[69]

> 'As I understand it RAAF personnel are able to liaise with DSMA – AF WGCDR Brett Woods and his staff and he has acknowledged his duty of care to all RAAF personnel – regardless of where they work. Within SCA the [official] order of contact for OH&S issues was first to your supervisor, then to the unit OH&S representatives and the OH&S Officer, and then SO2 OH&S in the SCA headquarters, then I would liaise with DSMA if required'[70].

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63 IOI.0021.071. Brief for CAF on the scope of F111 Fuel Tank OH&S Problems. AVM Weller. 13 Apr 00.
64 MAN.0025.001 Witness Statement of Linda Kaye. at page3 par 9.
65 MAN.0025.001 Witness Statement of Linda Kaye. at page 8 par 31.
66 MAN.0025.001 Witness Statement of Linda Kaye. at page 9 par 35.
67 MAN.0025.001 Witness Statement of Linda Kaye. at pages 8-9, pars 33-34.
68 MAN.0025.001 Witness Statement of Linda Kaye. at page 12 par 46.
69 MAN.0025.001 Witness Statement of Linda Kaye. at page 13, par 49.
70 MAN.0025.001 Witness Statement of Linda Kaye. at page 13, par 49.

GUIDANCE

2.48. Guidance on procedures and processes should be provided with all policy and instruction documentation. Not all OH&S policy documents within the ADO provides such guidance[71].

2.49. AVM Weller states that the 'ADF must recognise that some risks are involved in this area and ensure that robust OH&S practices are put in place. These must amount to something considerably more than the ADF simply expecting Commanders to accept responsibility under state and federal legislation'[72].

2.50. The concept of placing responsibility upon Commanders does comply with the intent of the OH&S act to make those in charge responsible for the safety of those within their supervision. However the Act states that the 'employer' is to be responsible and in this case the employer is the ADO. If the ADO wishes to delegate, for the sake of practicality, this responsibility, it follows then that the ADO needs to ensure that consistent and adequate resources, information and support services are available to Commanders so that they can fulfil these responsibilities.

2.51. Due to a perceived lack of guidance concerning OH&S, 501WG has, to a degree, taken steps in implementing OH&S standards independent of the larger organisation. The following statement is an example of this:

> '… 501 Wing had been looking at setting up a safety management system based on, ISO9000 (or AS 4801 and/or 9001) due to the level of activity in market testing. DSMA were heading down a different path using the AS/NZS4360 Risk Management for the Department. The quality side of SCA was moving down the ISO9000 compliance path'[73].

2.52. WGCDR Morrison highlights the fact that 'there is currently no forum in which Commanders and Managers can routinely address issues affecting the responsibilities of Command including OH&S management within the framework established by each program. Commanders require the support of the chain of command to address these issues'[74].

2.53. 501WG EMOHSO, Hal Waddington, states that there is a lack of corporate guidance with regard to AS/NZS 4804 development and implementation of an OH&S system and DOHSMAN policies[75]. According to Mr Waddington, the DSMA website Management System Audit tool still does not define a compliant AS/NZS 4800 series management system[76]. He further states that there is currently no corporate guidance for integrating the OH&S system with other business systems to ensure OH&S aspects of design and acquisition are factored into the Defence organisation programs[77].

2.54. In general terms, Mr Waddington purports that guidance documents (ADF publications, AAPs etc) do not provide a clear hierarchy of documents or act as 'roadmap' to describe program inter-relationships between components of the OH&S system. He describes the documentation as 'fragmented' and the resulting situation is one of 'confusion'[78]. He further expresses an opinion that such documentation is also inadequate in

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71 EXP.0009.001, Report by Aerosafe Risk Management Pty Ltd at page 51.
72 IOI.0021.069., Brief for CAF on the scope of F111 Fuel Tank OH&S problems. AVM Weller. 13 Apr 00.
73 MAN.0025.001 Witness Statement of Linda Kaye, at pages 11-12 par 45.
74 HRG.0005.001 Witness Statement of Adrian Scott Morrison, at page 1.
75 MAN.0007.001 Witness Statement of Hal Waddington, at page 15 par 57.
76 MAN.0007.001 Witness Statement of Hal Waddington, at page 14 par 56.
77 MAN.0007.001 Witness Statement of Hal Waddington, at page 15 par 57.
78 MAN.0007.001 Witness Statement of Hal Waddington, at page 15 par 58.

that it does not specify the way in which safe processes should be designed, staffed and with what OH&S competencies ranges to ensure environmental and OH&S issues are appropriately assured[79].

PROCEDURE

Suitability

DOHSMAN

2.55. WGCDR Morrison states that:

> 'To the knowledge of 501WG, the DOHSMAN was issued without any guidance as to how it was to be implemented across the Defence organisation or any particular effort to ensure that Commanders and Managers were made aware of the responsibilities contained therein. In short there seems to have been no implementation or training plan associated with its introduction from either the DPE (the sponsor of the DOHSMAN) or the individual programs. Additionally there appears to have been no effort from the DPE to measure compliance with the DOHSMAN or provide ongoing guidance to Commanders as to the performance of their units through such means as visits or audits"[80].

2.56. This lack of program oversight, coupled with the fact that the DOHSMAN offers 'very little information, guidance or resources to actually implement its requirements', effectively means that each Defence element is 'substantially left to its own devices to implement its own procedures'[81]. He describes the DOHSMAN as essentially being 'a compendium of policies and standards'[82].

2.57. 501WG EMOHSO Hal Waddington's view is similar to WGCDR Morrison's on this matter. Mr Waddington states that the DOHSMAN is 'effectively a series of policy documents covering specific hazard issues, but lacking, in many cases, adequate templates to perform the work required'. To illustrate this point, Mr Waddington identifies Annex A of Chapter five as lacking a MSDS register or Health Risk Assessment Formats. He states that this then requires the relevant OH&S personnel to source their own information with regard to this[83]. The potential for inconsistencies resulting from this is apparent.

2.58. 501WG OC, GPCAPT Sargeant states that the DOHSMAN and OHSMAN are not sufficiently instructive in that they do not provide a cohesive body of policy which gives clear direction on OH&S implementation nor do they provide guidance on a full range of issues which need to be addressed[84].

Other Instructions

2.59. It is also stated that substantial parts of USAF Technical Orders, were incorporated into AAPs without being subject to any RAAF guidance or review by way of a RAAF Supplement. There are associated problems with bringing a range of USAF instructions directly into RAAF service. An example given by WGCDR Morrison may be found in Section 1 of TO 1-1-3 (introduced into the RAAF in 1995 as AAP 7027.292.001-1) which describes the USAF maintenance and OH&S management systems, responsibilities of supervisors etc. Many such systems/items are not appropriate under the RAAF environment[85].

2.60. WGCDR Morrison further states that even after the issue of a Supplement, the content regarding standards in RAAF Supplement No 5 to AAP.7027.292.001-1 is

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[79] MAN.0007.001 Witness Statement of Hal Waddington, at page 15 par 59.
[80] HRG.0005.001, Witness Statement of Adrian Scott Morrison, at page 18.

'substantially dissimilar' to those standards referred to by the DOHSMAN, yet both documents are current[86].

2.61. SQLDR Beighton states that current Defence Instructions have not kept up with changes[87].

> 'For example, I have been provided with a copy of DI (AF) PERS 56-15 which relates to the identification, evaluation and control of workplace hazards. This Instruction refers to the responsibility of DAFMED (which ceased to exist several years ago), actions in accordance with Supply Instructions (also cancelled several years ago) nor is there mention of DSMA or DSM (AF)..The information on the DSMA website often contradicts those Defence Instructions provided in hard copy by the same department.'

Compliance

PPE

2.62. AVM Weller stated in his Brief to CAF that 'although the PPE underwent an approval process, some of it might not be suitable for the activity in light of contemporary knowledge'[88].

2.63. The Support Equipment Logistics Maintenance Unit of Support Command Australia (now part of the Defence Materiel Organisation) is responsible for maintaining the RAAF list of approved PPE. The list is just an inventory of PPE. It is not task specific, in that it does not address the following issues:

a. The environment in which the PPE is approved for use, eg confined spaces;

b. The chemicals for which the PPE is approved for use; and

c. The tasks for which the PPE is approved for use[89].

2.64. There is no central authority within the ADO vested with the responsibility of assessing such factors. In RAAF the responsibility vests with the Base Environmental Health Officers. Where there is a request for particular PPE by the section, the Base Environmental Health Officer is responsible for assessing the task and choosing appropriate PPE from the list of RAAF approved PPE. There is no procedure for the review of the chosen PPE or evaluation of the considerations that went into making the decision[90].

Training

2.65. Appropriate and timely training lies at the heart of an effective SMS. A problem within the current RAAF training system is that the delivery of OH&S training packages is very disjointed[91]. The Headquarters Command Safety Manager at HQTC states that he is constantly reminding Commanders of the availability of this training and the legislative requirements to have members trained. The response to his reminders varies from Base to

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81 HRG.0005.001, Witness Statement of Adrian Scott Morrison, at page 18.
82 HRG.0005.001, Witness Statement of Adrian Scott Morrison., at page 18.
83 MAN.0007.001 Witness Statement of Hal Waddington, at page 19 par 59.
84 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings. R J Sargeant, at pages 14-15; 28 Feb 01.
85 HRG.0005.001 Witness Statement of Adrian Scott Morrison, at page 19.
86 HRG.0005.001 Witness Statement of Adrian Scott Morrison, at page 19.
87 MAN.0028.001 Witness Statement of Paul Beighton dated 18 May 2001 page 15 par 38
88 IOI.0021.069. Brief for CAF on the scope of F111 Fuel Tank OH&S Problems. AVM Weller. 13 Apr 00.
89 MAN.0109.001, Witness Statement of Philip Blanck. p 18-19, par 41.
90 MAN.0109.001, Witness Statement of Philip Blanck. p 19, par 42.
91 MAN.0109.001, Witness Statement of Philip Blanck. p 11-12.

Base and is subject to factors such as, the operational demands of the Base, the resource demands, particularly the availability of personnel, and/or downsizing or out-sourcing pressures. RAAF Base Amberley has generally been very responsive to the needs for this type of training. However the market testing of 501 Wing has placed pressure upon 501 Wing personnel[92].

2.66. A further problem that the Command Safety Manager has encountered regarding the management and coordination of Occupational Health & Safety training is the desire of Commanders and their subordinates to engage in courses other than those provided by the RAAF contractors. In recent times, a number of Commanders have preferred to have personnel receive the National Safety Council of Australia Occupational Health & Safety Course (a course of ten days duration) as opposed to the RAAF specific courses. This additional training is not focussed towards service specific requirements and therefore should not be undertaken in substitution of service training[93]. Such practices have the potential to produce fractured OH&S education within the ADO.

2.67. The current Director of the Air Force Ground Safety Agency (AFGSA) believes that an overhaul of the Air Force safety training is urgently required[94]. The training should be competency based and be aimed at the following:

a. Airman mustering training;

b. Officer specialisation training;

c. Generic safety training;

d. Air Force senior officer training;

e. Squadron safety induction training;

f. Squadron on-the-job training;

g. Squadron specialist officer training; and

h. Base specialist officer tertiary training[95].

IMPLEMENTATION

Resources

2.68. Without appropriate resourcing, both human and material, an effective SMS cannot be achieved. WGCDR Ross prepared a report in relation to occupational health at 501WG in 2000. In his report he states:

> ‘Occupational Health and Safety within the RAAF, and ADF, is in a difficult situation, and this is reflected at Amberley. At least 501WG has its own, full time Occupational Safety officer. This situation is not reflected across the ADF. Many areas rely on minimally trained, part-time personnel for OH&S management. These people have primary duties other than OH&S, and will attend to health and safety matters as and when they can, or depending on the individual’s level of enthusiasm.
>
> In order to meet the Commander’s responsibility for providing a safe and healthy

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92 MAN.0109.001, Witness Statement of Philip Blanck. p 11, par 25.
93 MAN.0109.001, Witness Statement of Philip Blanck. p 11, par 26.
94 MAN.0012.001, Witness Statement of John Michael Rowe at page 10 par 28.
95 MAN.0012.001, Witness Statement of John Michael Rowe at page 10 par 28.

work environment, a Commander must have access to appropriate professional advice in a timely manner. The best way that he can be confident that he will be able to get this is to have OH&S personnel where he can direct what their priorities are. Thus, each base must have at least one person with Occupational Health and Safety tertiary qualifications, who is under the authority of the Base Commander.

In addition, all programs within Defence need to have an OH&S system which includes full time, qualified OH&S personnel at appropriate levels within the organisation that can provide practical support to Commanders. 501 WG is part of Support Command Australia. While a command structure is in place for OH&S, it is not populated by personnel with OH&S expertise, which leaves the system, and the personnel trying to manage it, very vulnerable'[96].

2.69. 501WG EMOHSO Hal Waddington makes the point that although the OH&S documentation (including the DOHSMAN and AAPs) might establish standards and provide direction in respect of safety, the ability of an individual or organisation to achieve those standards is limited to the level of funding provided to the program[97].

PROCESS OF IMPLEMENTATION

OH&S Process Approval System

2.70. It has been recognised that there is no established system where Commanders can obtain reliable, authoritative and timely advice on the Occupational Health and Safety aspects of a process[98]. In the RAAF, there is a structured and formal process of approval and authorisation for a process before it can be introduced for use on an aircraft. It has been proposed that this engineering concept is mirrored in an OH&S approval and authorisation process, where the CO or OC of a squadron/wing would authorise a procedure only after it had received approval from an appropriate agency. It is suggested that the proposed agency for the ADF is the Defence Safety Management Agency. It is further suggested that such a process, would greatly enhance the focus on OH&S in the organisation[99].

Linkage of PPE and Procedures

2.71. There is a PPE approval process in place whereby the RAAF will only purchase PPE, which has received endorsement. However, this is a generic endorsement, and does not link that piece of PPE with what types of activities it is appropriate, for it to be used with, or what chemical or other hazards it will protect against, and for how long. Thus, once the PPE is approved, it can be purchased legitimately within the RAAF, but potentially for an entirely inappropriate end use. A database is required, which will link all PPE with approved uses. It is proposed that such a database should be managed by DSMA, either in-house or on contract[100].

2.72. With the introduction of the OH&S Act in 1991, many of the Defence policies underwent review. Comcare Australia, the administrators of the Act, changed the approach to safety management from prescriptive policy to a risk management approach to safety. Comcare did this by means of Regulations made under the Act. Defence review and writing of safety policy changed to meet with the legislative focus. This resulted in the issue of

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96 501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report. WGCDR J. Ross. Apr 2000.
97 MAN.0007.001, Witness Statement of Hal Waddington, at page15 par 59.
98 501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report. WGCDR J. Ross. Apr 00. P 50.
99 IO Report. WGCDR Secker.
100 501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report. WGCDR J. Ross. Apr 00. P 50.

policy that was broad and open to interpretation. To be effective, policy needed to be rewritten by the Service safety officers, allowing the same material to be issued as instructions that were more readily understood and applied by military personnel. Both the safety management system and ENVH personnel provided advice on the application of safety orders, instructions and advisory documents[101].

2.73. In 1993, staff from the RAAF were transferred to the DDOHS. The RAAF safety management personnel continued to provide advice and support regarding the development of RAAF policy. It was understood that the DDOHS would provide policy for the ADF and the Department of Defence. It was also understood that the DDOHS would meet the safety needs of the whole Defence organisation. Following the transfer of staff the focus on policy development reportedly changed and the task of rewriting of policy was transferred back to the Program elements. The RAAF staff, however, were not transferred back with the task. It is not believed that this change was communicated effectively to the RAAF Program[102].

2.74. DDOHS focussed policy development on rewriting applicable Regulations into broad based policy at the expense of more focussed instructions for the high-risk areas of the ADF. It appeared that the needs of the legislator were of higher priority than the needs of Defence personnel. Many broad policies were issued but there was no one in the RAAF to provide the amendments for the issue of instructions. All transferred staff were being used to develop the broad policies in lieu of the specific policies needed by the RAAF. Policy became longer and harder to interpret. This resulted in many policies not being read by affected personnel. At the instigation of the Directors for Safety Management (DSMs) of the three Services, a summary of each in-depth policy will soon be issued for field use. This form of policy is hoped to be more readily used by personnel and will act as guidance on the larger policy. This form of policy has not been issued as yet[103].

2.75. There has been an ongoing argument within the ADF concerning the need for prescriptive policy versus non-prescriptive policy, based on a risk management approach to problems. Both forms of policy have a place in the safety manuals and will vary according to the subject. Unfortunately, many of the policies written by the DDOHS and the DSMA are too broad and require a rewrite to be effective in the Service groups. It is purported that the DSM (AF) did not have sufficient time to undertake this rewriting of policy and the DSM (AF) team had to rely on providing advice on implementation methods to the units. It is believed that units respond better to directives, or prescriptive policy, than to broad-based policy that does not apply directly to the workplace[104].

HAZARDOUS SUBSTANCES

Hazardous Substance Management

2.76. Until the mid 1990s the responsibility for the initial assessment of any chemicals intended to be used by the RAAF was vested in the RAAF Toxicologist, in Canberra. The responsibility now rests with the position of CSM-HQTC. The incumbent states that he does not have formal qualifications for the function[105]. Furthermore, the position is not staffed to adequately support this function. CSM-HQTC believes that the function should have been transferred to Support Command Australia in June 1997. Support Command Australia (now Defence Materiel Organisation (DMO)) is responsible for the maintenance and acquisition of capabilities. The introduction of new hazardous substances into existing or new maintenance procedures is said to be consistent with the other functions of the organisation. Currently CSM-HQTC sees that his responsibility is discharged through the out-sourcing of

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101 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 7-8 Par 21.
102 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 8, par22.
103 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 8, par 23.
104 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 8-9, par 24.
105 MAN.0109.001, Witness Statement of Phillip Blanck. p 17, par 39.

the chemical assessment and acceptance process to Chemwatch[106].

2.77. The CSM-HQTC was responsible for keeping a register of chemicals that are authorised for use in the RAAF. This is not a central register of available chemicals, nor is it a register of the geographical location at which chemicals are used. At any rate this register lost in the various Air Force reorganisations. Further, DSMA has to date not provided a register of this kind. As such, each Base is responsible for keeping a list of chemicals that are used. This responsibility may rest in a central Base repository or may be directed to Base sections. Therefore there may be a Central Base register or a series of registers kept by particular work places which identify the chemicals that are used and the circumstances in which they are used. This situation has reportedly arisen as there is no policy providing a uniformed plan regarding a hazardous goods register[107].

Introduction of New Materials (Aircraft/Hazardous Substances) and Processes

2.78. The Investigating Officer's Report states that 'Defence's occupational safety standards need to be specified up front during the acquisition process so that maintenance processes are developed or evaluated with the safety requirements in mind. There also needs to be visibility of the consideration given to occupational safety issues in development of the maintenance processes. Maintenance processes must prescribe not only what is necessary to maintain the technical integrity of the aircraft but also what is necessary to manage the risks to the health of the maintenance personnel who perform them'[108].

2.79. The report also purports that risks to the health of maintenance personnel need to be considered during the development of the maintenance processes as an integral part of the development process and not as an afterthought[109]. 501WG OC, GPCAPT Sargeant, states that Defence does not have an OH&S system that is capable of actually ensuring that when a new process (especially a complex process) is introduced, it is fully investigated[110].

Risk Management

2.80. The recent evaluation of risk management in Defence by the Inspector General Division observed that Defence does not have a corporate risk management policy. The report recommended that one be developed based on the Australian Standard for Risk Management[111]. The Standard provides a useful framework within which to consider occupational safety and suggests that the corporate risk management policy should identify who is responsible for managing occupational safety and the support and expertise available to those with this responsibility. The Inspector-General's report has recommended that a new organisation be formed in Defence Headquarters, possibly in the Management and Reporting Division, to develop and implement a Defence policy on managing risk[112].

2.81. According to a Risk Management specialist, deficiencies within the ADF are evidenced by the lack of comprehensive guidance or policy on risk management, risk assessment and hazard identification[113]. No one agency within the ADO currently has the responsibility to centrally manage, co-ordinate and oversee all dimensions of risk management. Without an agency to provide centralised risk management, the

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106 MAN.0109.001, Witness Statement of Phillip Blanck. p 17, par 39.
107 MAN.0109.001, Witness Statement of Phillip Blanck. p 18, par40.
108 IO Report. WGCDR Secker. at page 5-5 par 5.15.
109 IO Report. WGCDR Secker. at page 5-5 par 5.15.
110 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings. GPCAPT R J Sargeant. 28 Feb 00, at page 18.
111 Risk Management in Defence, 2000, Defence Publishing Service, Canberra, Chapter 6.
112 Risk Management in Defence, 2000, op cit, at par 6.16.
113 Transcript of Proceedings. K A Turner. EXP.0009.001, Aerosafe Risk Management.10-May-01.p 629.

implementation of risk management policy becomes a difficult task[114].

2.82. The SHE Pacific Report states:

> ‘Risk assessment is a pervasive activity within Defence, yet there does not seem to be a recognised need for different approaches in different circumstances or a consistent approach in similar circumstances. Risk assessment should become one of the standards of the OHS management system’[115].

2.83. Similarly, the 501WG EMOHSO states that Defence does not have a central OH&S risk management process. He states that the existing risk management process does not require the systematic identification and review of all processes against a full list of hazards. Instead the process relies on a fragmented hazard approach derived through the DOHSMAN document structure[116].

AUDIT & REVIEW

Incident Reporting

2.84. According to the 501WG EMOHSO, there is an absence of a well-defined incident investigation model. This results in a propensity for the root causes of incidents to go undiscovered and the opportunity to rectify potential hazards is lost.[117].

2.85. ‘Defence should be encouraged to adopt a consistent process for incident investigation and reporting, as is suggested throughout this report. Incidents and injuries need to be investigated in order to understand the true issues associated with the event and to provide robust statistics which can be examined to assist in planning for OHS improvement and to take corrective actions. This procedure should be incorporated into the OHS management system mentioned above’[118].

2.86. The DOHSMAN acknowledges that accidents and incidents generally indicate a weakness in systems, procedures or training and should be investigated to determine the causes and the subsequent action necessary to prevent re-occurrence. It further provides that the level of investigation to be undertaken should be determined by the circumstances of the accident and the severity of the consequences[119]. This is not elaborated upon. No prescriptive terms are outlined as to the forms to be used to report an incident, how to conduct an investigation or who is to conduct such an investigation etc. The DOHSMAN references AS 1885.1 as a relevant standard. It is unclear whether the extent of information provided in the DOHSMAN is sufficient to enable the relevant accountable persons to perform their job effectively.

> ‘Once an incident has been reported, it needs to be investigated. During the investigation the real or root causes are found and corrective actions are determined’[120]. Every incident is an opportunity to correct errors, learn from mistakes, strengthen the SHE culture and reduce the organisation’s costs’[121].

2.87. Despite the reporting requirement and ongoing efforts to promote reporting, it is the estimation of DSMA that, less than ten percent of reportable incidents result in the

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114 Risk Management within the ADO: Report prepared for the F111 Deseal/Reseal Board of Inquiry. Apr 01 at page 9.
115 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 79.
116 MAN.0007.001, Witness Statement of Hal Waddington, at page16 par 66.
117 MAN.0007.001, Witness Statement of Hal Waddington at page 16 par 63.
118 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 79.
119 DOHSMAN. Chapter 2 Notification, Reporting, Audits and Investigations, Annex C.
120 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 41.
121 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 51.

completion and submission of the Form AC563, Incident and Fatality Report Form. DSMA currently receives around 8000 AC563 reports annually.[122] The total reporting for RAAF currently is in the vicinity of six hundred reports, which may be seen as representing quite a low level of reporting. [123]

> 'All the best practice organisations admitted that encouraging reporting was a critical component of data integrity but difficult to achieve and required careful cultivation'[124].

2.88. A possible explanation for this seems to be that the report forms are not user-friendly. There is a general consensus within RAAF units that the AC563 (Incident Reporting form) was difficult to complete and rather lengthy. The form was purportedly released without supporting policy, instruction or direction from the ADF[125].

2.89. The attitude that writing an incident report is difficult; compounded by a general desire not to 'air the units dirty linen', and a lack of resources and time necessary to compile reports, has resulted in an emerging culture of non-reporting[126]. DSMA research indicates a high level of awareness in the ADO of the requirement to report but a cultural disinclination to do so[127]. This is said to severely limit the capacity of DSMA to identify issues and trends to assist the Groups in taking a more pro-active approach to safety management[128].

2.90. However, the Incident and Fatality Report-Form AC563 has recently been significantly redeveloped, reducing in length from seven to three pages in an attempt to make the reporting of incidents a less onerous chore. A new policy on incident and fatality reporting, supporting the new form is reportedly ready for imminent release[129].

HEALTH SERVICES

General

2.91. The agencies with Occupational Health responsibilities have been subject to the same adjustment difficulties as a result of restructuring as other components of the ADO. Currently, the Defence Health Services Branch (DHSB) is responsible for Occupational Health and the DSMA is responsible for safety management[130]. This division of responsibility between occupational health, and safety, did not always exist. It is held that prior to 1993 the two systems were separate. The Directorate of Air Force Safety (DAFS) comprised both flying safety and ground safety (now safety management) personnel. The health services controlled ENVH who undertook occupational health assessments[131].

2.92. With the establishment of the DDOHS, ground safety staff were transferred from DAFS to the DDOHS. DDOHS was at the time organisationally located within the health services. DAFS changed its name to the Directorate of Flying Safety (DFS) with the transfer of personnel to DDOHS. Safety management for the RAAF was then located in the Office of the Surgeon General Australian Defence Force (OSGADF) who had Tri-Service responsibilities. For one year the occupational health and safety systems were part of the Defence health services. The DFS was organisationally located in the RAAF Program as a specialist safety system. No ground safety personnel were located in the RAAF program. At

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122 MAN.0019.001, Witness Statement of Glen Tye, at page 17 par 49.
123 MAN.0113.001, Witness Statement of William Brett Wood, at page 10 par 29.
124 Review of the DEFCARE Computer System, February 2001, SHE Pacific Page 32.
125 MAN.0113.001, Witness Statement of William Brett Wood, at page 10-11 par 30-31.
126 MAN.0113.001, Witness Statement of William Brett Wood, at page 10 par 29.
127 MAN.0019.001, Witness Statement of Glen Tye, at page 21 par 71.
128 MAN.0019.001, Witness Statement of Glen Tye at page 21 par 69.
129 MAN.0019.001, Witness Statement of Glen Tye, p 21 par 70.
130 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 22, par 69.
131 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 22, par 71.

the end of 1993, early 1994, the DDOHS was split from the health services and placed in the personnel branch of the Department of Defence. The two elements were again separated.

2.93. The inadequacy of ground safety personnel numbers within the RAAF Program was recognised and the Directorate of Environmental Management and Occupational Health and Safety (DEMOHS) was established in early 1995 to manage environmental and safety management issues. The title still contained the term occupational health but in reality these issues were the responsibility of the health services[132].

2.94. The DEMOHS was disestablished by the DRP at the end of 1997 and the safety staff transferred into the DDOHS. Again, the RAAF was left with no ground safety staff. DDOHS was reorganised in 1999 and became the DSMA. The connection between occupational health and safety management systems was not re-established even though many organisational adjustments have been made.

2.95. In the early nineties the ENVH cell in the RAAF health services consisted of a medical officer, two ENVHOs, one EHSURV and a toxicologist. These personnel managed the prevention policies and management of occupational health in the RAAF. They also provided a link to the DAFS ground safety staff. With the reorganisation of the health services and DRP these positions were lost or redeployed to other curative medicine positions within the health services. It was only in late 1999 that an EHSURV was again posted to the Defence Health Services Branch (DHSB) to provide advice on occupational health issues in the field.[133]

2.96. A new cell was created in the DHSB that included an occupational health physician, a nursing officer and an EHSURV. The role was to undertake an occupational medicine review of the health services and Defence. There was a lot of commonality with the role of the DSMA and communication links were established.

Health monitoring

2.97. Health monitoring is the responsibility of the Defence Health Services Branch (DHSB). Safety management (the responsibility of DSMA) ensures that systems are in place to identify hazards in the workplace and that mechanisms for resolution of such hazards are available. Occupational health (the responsibility of DHSB) assesses the problem or hazard and relates the results to the potential for adverse health outcomes. Both systems are preventive in nature and are said to complement each other.[134]

2.98. ENVH personnel are in the command and control system of the DHSB and are responsible for monitoring the health of personnel in their workplace. ENVH are also responsible for conducting Occupational Health Assessments (OHAs) of personnel exposed to a range of chemical substances defined by the NOHSC, audiometric surveillance and industrial hygiene assessments of the workplace to name just a few. Policies are in place for these OHAs to occur. [135]

2.99. A detailed analysis of health monitoring issues may be found in Chapter 10 of this report.

Audit/Workplace Inspections

2.100. The duty statement of DSMA Command Safety Manager includes the responsibility for conducting safety management audits and inspections of Training Command establishments. However, a feasibility study, undertaken soon after the formation of DSMA decided that due to insufficient personnel resources, audits were simply not possible. The feasibility study further recommended that each unit should conduct its own audits and

[132] MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 23, par 72.

inspections[136].

2.101. Thus, the responsibility for auditing was delegated from a supervisory body to the workplaces themselves. It is clear that this, in effect, undermines the concepts of an independent audit conducted by suitably qualified professionals as required by the OHSMAN[137].

2.102. The internal audit process has been endorsed, as there was little choice but to take this position. However, DSMA has no mechanism in place to review the audits generated.

2.103. As such, it is not clear how many units have actually complied with Defence instructions to undertake annual audits. To overcome this problem, DSMA have relied on Comcare Australia to undertake external audits and have used the resulting audit reports to get a clear picture of the state of safety within units. Comcare audits are done randomly and reports are channelled through a cell within the DSMA to ensure clarity and uniformity in the responses to and from Comcare.[138]

2.104. The OHSMAN, Chapter 27, sets down no time frame for audits, stating that Committees are responsible for deciding the frequency of auditing. Senior Management, OH&S Committees, OH&S Officers, or a Health and Safety Representative are the personnel given the authority to commission an audit. DI (AF) (PERS) 60-7 states that COs are responsible for ensuring that audits take place at least annually. 501WG Manual states that EMOHSAs and SITLs have the responsibility of setting the audit schedule but does not state a requirement for annual audit.

2.105. There seems to be a degree of disparity running through the chain of instruction as to the responsibility for commissioning, and the rate of audits. The OHSMAN, as the highest level instruction, might be deemed as lacking in sufficient detail so that the DI and subsequently SI could not follow on from its intent. The relevant DI has made audits compulsory and given the responsibility to the CO, the 501WG Manual appears to delegate that authority to the EMOHSA, and SITLs. It is unclear as to whether the Committees actually had the function or authority to call for an audit. If the intent of the OHSMAN was to make auditing the responsibility of OH&S Committees, it would seem that this did not eventuate.

2.106. Further, as outlined in SCAI (PERS) 6-1, Support Command Australia was to coordinate an external audit of each section, on a 3-year rolling schedule. As discussed earlier, this did not occur.

COMPARISON OF "AN EFFECTIVE SMS" TO SAFETYMAN

2.107. With the DOHSMAN coming under some criticism, as stated above, it is important to consider its intended replacement, the SafetyMan. To determine the suitability of the SafetyMan, (the proposed Safety Manual for Defence) it is hereunder measured against the recognised elements of an effective safety management system (SMS) taken from the elements outlined in Chapter 13, 'Elements of an Effective Safety Management System'. The elements taken from Chapter 13 are **in bold** for ease of comparison and a short analysis on whether the SafetyMan meets or falls short of meeting such requirements is contained in each section. According to the analysis done in Chapter 13 an effective SMS should include:

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133 MAN.0113.001, Witness Statement of WGCDR Brett Wood. p 23, par 73.
134 MAN.0113.001, Witness Statement of WGCDR Brett Wood.
135 MAN.0113.001, Witness Statement of WGCDR Brett Wood.
136 MAN.0109.001, Witness Statement of Phillip Blanck, at page 17 pars 44-45.
137 OHSMAN. Chapter 27 Audits and Inspections.
138 MAN.0109.001, Witness Statement of Philip Blanck.

a. A Clear Policy Statement;

b. legislation as minimum standard;

c. Clearly set-out Group and individual responsibilities;

d. A Joint Occupational Health & Safety Committee;

e. Health and Safety rules;

f. Employee Orientation;

g. Training;

h. Workplace Inspections and Audits;

i. Accident Reporting and Investigation;

j. Emergency Procedures; and

k. Risk Management.

Clear Policy Statement

2.108. The policy statement of the ADO states management's commitment to protect the health & safety of employees through its statement in paragraph 1 – "This policy confirms our commitment to provide the safest possible environment for all people in Defence workplaces".

2.109. The objectives of the OH&S program are stated briefly in paragraph two as 'the goal of ensuring health & safety' with paragraph four stating that 'measurable health & safety goals and strategies' are to be included in lower level policy (Portfolio & Group Corporate Plans). The organisation's basic health & safety philosophy runs through the entire policy but is captured predominantly in paragraph seven which outlines an emphasis on risk management and collective responsibility to maximise operational capability.

2.110. The general responsibilities of all employees are stated as being:

a. To give most careful attention to how their work is conducted with regard to health & safety;

b. To report accidents and hazards to their supervisor to enable corrective action to be taken;

c. To avoid increasing or creating risk; and

d. To fulfil their responsibilities to themselves, others and the ADO.

2.111. By outlining the responsibilities of Commanders (paragraph 3 & 5) and DSMA (paragraph 5) the policy seems to meet the requirement of stating accountability for OH&S programs.

2.112. The element that health and safety will not be sacrificed for expediency is not explicitly stated. However, this intent is perhaps met through the final statement of the policy, that 'the safety and welfare of our people are of paramount importance'. Further, it might be conceded that in the particular case of Defence, it is more difficult to balance safety goals with operational capability (linked to expediency).

2.113. It is stated at paragraph 6 that 'supervisors will ensure that employees work in a manner that protects their health…by utilising appropriate protective measures and procedures', and in paragraph 7 that 'we expect all personnel to fulfil their responsibilities…'. The policy statement does not make a direct statement concerning an intolerance for non-compliance nor does it mention disciplinary action etc. Thus, it is unclear as to whether the policy statement can be seen to include this element of a comprehensive policy statement.

2.114. However, the policy statement appears to be stated in clear, unambiguous and unequivocal terms. It is the current statement and is signed by the incumbent CEO (in this case the CDF and the Secretary). Whether it is communicated to each employee and adhered to in all work activities can not be commented on.

2.115. A health & safety program must include elements required by the relevant health & safety legislation as a minimum[139]. As stated previously, the SafetyMan is derived from the relevant legislation, the OH&S (CE) 1991 Act, as well as other standards and guidance doctrine. Chapter 1 of the SafetyMan provides information outlining the intention for the SafetyMan to act as the principle agency in implementing the objectives of the Act into the ADO. The general intent of the Act to make employers responsible for safety is faithfully carried though into the SafetyMan which delegates this responsibility to all Commanders. Other, more specific provisions of the Act, such as those covering emergency procedures[140], incident reporting to Comcare[141], the appointment of Health and Safety Representatives[142], the formation of Designated Work Groups[143] and health & safety committees[144] etc are also 'picked up' by the SafetyMan. The Manual makes constant reference to compliance with the Act throughout the text. In this way, the SafetyMan may be seen to meet the criterion of 'including elements required by health & safety legislation as a minimum'.

Joint Occupational Health & Safety Committee

2.116. Chapter 2 of the proposed SafetyMan provides that a safety committee structure should exist at the workplace level. It is stated that management, supervisors and employee representatives should comprise the attendees/members of the committee. This would appear to adhere closely to the concept of a cooperative and consultative relationship between employees and management, outlined as a necessary element of an effective SMS. Annex A to Chapter 2 provides a flow chart which identifies the requirement for safety committees at section, unit, division (wing/squadron), command and finally executive level. Annex C to Chapter 2 sets out the composition, scope and terms of reference for group safety committee meetings. Among the specific functions of workplace safety committees, are the following :

a. Accident/dangerous occurrence reports;

b. Workplace inspections;

c. Safety officer reports;

d. Hazard identification;

e. Safety training and health promotion; and

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140 The Occupational Health & Safety (Commonwealth Employees) Act 1991. Part 3. Division 3.
141 The Occupational Health & Safety (Commonwealth Employees) Act 1991. Part 4, Division 2 & 3.
142 The Occupational Health & Safety (Commonwealth Employees) Act 1991. Part 3, Division 1, Section 25.
143 The Occupational Health & Safety (Commonwealth Employees) Act 1991. Part 3, Division 1, Section 24.
144 The Occupational Health & Safety (Commonwealth Employees) Act 1991, Part 3, Division 2.

f. Ensuring the currency of policy and procedures.

2.117. This appears to constitute the necessity to provide clear statement of purpose, duty and terms of reference for health & safety committees.

Emergency Procedures

2.118. Chapter 3 of SafetyMan covers Safety & Emergency Management in some detail. It states that the formation of a safety & emergency management committee (SEMC) is required. The OC/CO (or delegated senior officer) is stated as being required to take on the role of Executive Safety & Emergency Coordinator (ESEC) and chair the SEMC.

2.119. The role of the ESEC[145], DSMA, Defence Corporate Support (DCS) and Regional Health & Safety coordinators[146] are detailed. Annex C sets out the terms of reference for the SEMC.

2.120. Specific emergency procedures are intended to be formulated by committees at workplace level so that hazards particular to that workplace may be planned against. In this way, the SafetyMan may be seen to provide the necessary guidance towards the development of emergency procedures, while not actually setting out actual procedures.

Safety Training

2.121. An effective SMS requires appropriate training to facilitate acceptable skill standards and the awareness of hazards. Chapter 6, Volume 1 of the SafetyMan is concerned with OH&S training. The chapter includes the responsibility of each organisational level to ensure the appropriate training of its subordinates. It states a requirement for specific training for workplace health & safety committee members and health & safety representatives.

2.122. Annex A details a number of general and specific safety training courses currently provided by the ADO. Volume 2, Part 4, Chapter 22, which is yet to be developed is intended to specifically deal with Air Force Safety Training. The manual seems as comprehensive as practical for this level document with more specific details (as applicable for each branch or unit of defence) necessary to be incorporated into lower-level instructions.

Reporting & Investigating Accidents

2.123. An effective SMS is stated as having the integral element of accident reporting and investigation in order that measures may be taken to prevent recurrence.

2.124. Chapter 9, Notification, Reporting & Recording of Incidents & Fatalities, outlines the legislative requirement (under the OH&S Act [1991]) to notify and report incidents to Comcare. It provides details on the standard form to use for this purpose. At Annex A is a sample of the form (AC 563).

2.125. Further, Chapter 9 outlines the responsibilities of the CDF and Secretary, DSMA, Group Executive, Commanders, Supervisors, Safety Coordinators & Advisors and ADO employees to report incidents.

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[145] SafetyMan. Volume 1. Chapter 3. Annex A.
[146] SafetyMan. Volume 1. Chapter 3. Annex B.

2.126. Annex B of this chapter provides information concerning the notification and reporting procedures, with Annex C providing a procedural checklist for such reporting.

2.127. Chapter 12 relates information regarding Comcare, which states that its priority one function is to conduct fatality investigations, reactively, in response to the notification of the occurrence of such an accident/incident. A secondary function is then to conduct inspections, based on trends of recurring injuries within a particular workplace. Comcare also conduct compliance audits. The chapter briefly sets down the power of Comcare to access premises, to issue prohibition or improvement notices, and to take possession of plant, sample or substances.

2.128. The system, documentation and procedures of reporting incidents as well as the powers of the receiving authority for such reports and notification, seems fairly comprehensively laid out within the SafetyMan.

Group and Individual Responsibilities

2.129. An effective SMS is said to provide a clear statement of the responsibilities of specific workplace members. Further to this, these members are to be made fully aware of these responsibilities.

2.130. The heading of RESPONSIBILITIES features in all the Chapters of the SafetyMan which deal with matters which conceivably have associated responsibilities. Responsibilities are set down with regard to most issues. Examples of this (from both available chapters) may be found in the information concerning the implementation of the Act into the ADO[147], Hazardous Substances Management[148] and SMS Audits in the AF[149].

2.131. The responsibilities, where appropriate, include those of the CDF & Secretary, DSMA, group executives, Commanders, Supervisors, Committees and employees generally. Considering that responsibilities form such a integral part of the manual it may be seen that the proposed SafetyMan meets the requirement of an effective SMS in spelling out the responsibilities of involved groups and individuals.

Health & Safety Rules

2.132. To some extent, the entire manual is a culmination of health and safety rules. General Health & Safety rules are provided in most chapters in some form or another with regard to specific issues. For instance, Volume 1, Part 5, Chapter 5 states that “PPE is to be worn by all personnel when working with unstable composite materials”, it then goes on to briefly state the three main types of PPE (Respiratory, Eye and Skin protection). This might reasonably be seen to constitute a ‘safety rule’. However, obviously it does not provide enough information to stand alone as a safety rule for use in the workplace. Brands and exact specifications of PPE to be worn with particular chemicals in a particular environment and other information is left to be detailed in lower level defence instructions and orders.

2.133. Because of the highly diverse, highly technical environment of defence workplaces, it is simply not feasible to provide safety rules in any detail in the Safety Manual. However for its general purposes, the SafetyMan seems to provide a starting point for developing adequate safety rules in relation to the issues it covers.

Employee Orientation

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[147] SafetyMan, Volume 1. Part 1. Chapter 1.
[148] SafetyMan, Volume 1, Part 5. Chapter 1.
[149] SafetyMan, Volume 2, part 4, Chapter 11.

2.134. As inexperienced workers have been found to be involved in accidents at a higher rate than others, It is considered an important element of an effective SMS to begin health & safety education with an employee induction for members joining the organisation or transferring from another section.

2.135. Annex A to Chapter 6 of Volume 1, part 1 sets out the content of the OH&S induction brief for new employees. It is stated as taking one hour and covering the following topics:

a. The management of OH&S in Defence;

b. The role of management;

c. The role of supervisor;

d. Health and safety representatives;

e. Notification/reporting of OH&S incidents; and

f. The use of the DSMA web-based OH&S system.

2.136. While the various roles and responsibilities for health and safety and the need for the reporting of incidents seem to be covered, information concerning a number of issues provided in a comprehensive induction program under an effective SMS are not covered by this brief course outline. It is recognised that a good SMS workplace-induction should include a discussion of emergency procedures, the location of first aid stations, use of PPE, the right to refuse hazardous work (this is covered under the Defence Occupational Health & Safety Agreement and is applicable to civilian workers)[150], and a discussion of hazards particular to that work-site. These elements are not contained in the above topics list and are not included in the induction program.

2.137. Volume 2 dictates under chapter 4 of part 4, a specific brief is to be developed for contractors and visitors to a particular defence establishment. The SafetyMan provides an example of an induction brief for contractors. The example seems quite comprehensive but would of course be subject to the needs of the particular workplace. While there does seem to have been a more detailed consideration of induction training for contractors, the same cannot be said of induction for Defence personnel.

Workplace Inspections and Audits

Workplace Inspections

2.138. Regular workplace inspections are stated as an important element in an effective SMS.

2.139. Annex E to Chapter 2, part 1, Volume 1 of SafetyMan discusses the need for safety inspections in terms of identifying hazards. The annex directs the reader to the DSMA web-site tools that provide assistance in the form of workplace inspection checklists. The web-site is stated as also having the capacity to record information such as inspection findings, corrective actions etc. To help identify the level of risk associated with an identified hazard, the web-site provides a risk-calculator tool.

Audits

2.140. Chapter 10, of part 1,Volume 1 deals with Safety Management Systems Audit. The

[150] SafetyMan, Volume 1, part 1, chapter 4, Annex A.

two types of audit mentioned are the internal audit and Comcare investigations. Information concerning the principles for planning an audit are provided at Annex A. Also at Annex A, a checklist for documents to be examined from the audited workplace and a work-sheet to assist in the preparation of the audit schedule is provided. Checklists are considered important to ensure that no items are overlooked. It is considered appropriate to set down the prescribed audit frequency. Further, for an audit to have any real purpose it must be ensured that corrective/remedial action is undertaken in order to ascertain that identified hazards are actually rectified.

2.141. Chapter 11, part 4, Volume 2 of the SafetyMan sets out details concerning SMS audits in the Air Force. The chapter refers the reader to the relevant Defence Instruction. The use of the DSMA intranet web tool is recommended. It is a stated requirement to conduct an audit every twelve months, thus effectively setting an audit frequency. It is stated as a requirement for audit reports to be forwarded to Command Safety Managers (part of DSMA). While this may be seen as a step in the direction of monitoring identified hazards and associated corrective actions, this measure cannot be seen in itself to provide any guarantee that appropriate remedial action is always taken. There are no audit checklists per se provided within the SafetyMan. This may again be because checklists of a more specific nature are to be provided in lower level instructions.

Risk Management

2.142. The identification, assessment and control of hazards forms an integral part of risk management. Risk Management has been identified in the Regulations under the Occupational Health and Safety Act (1991) as being an important component of a SMS.

2.143. Chapter 7, part 1, Volume 1 outlines the responsibilities for hazard and risk management held by various positions within Defence. Annex A to this chapter provides information concerning Comcare guidance booklets and the DSMA web-site which provides facilities to record hazards, assess the risks using a risk score calculator, prioritise control options and allocate tasks in the implementing of controls. The Annex outlines the circumstances where hazards may be identified, and the appropriate circumstance to undertake a risk assessment. The controls to minimise or eliminate risk are listed in a hierarchy. Annex A further provides a list of factors that together are to be used to determine the degree of risk posed by a hazard.

2.144. Risk Management is also dealt with under the parts of Volume 1 concerning Physical Hazard Management (part 3) and Hazardous Substances Management (part 5).

2.145. Chapter 7, of part 4 of Volume 2 of the SafetyMan titled “Risk Assessment and Management” provides that the concepts of ‘seriousness of consequences’, the ‘level of exposure’ and the ‘likelihood of an incident occurring’ are to be considered when assessing risk.

2.146. As risk management is incorporated into a number of different areas of the SafetyMan, it might be considered that the manual gives the concept of risk management sufficient importance (at least at this level) to be considered to fulfil this requirement. The extent to which this ‘incorporation’ proves adequate is yet to be seen.

CHAPTER 4- COMPARISON OF RAAF WORKSHOP SAFETY MANAGEMENT SYSTEM WITH OTHER SAFETY MANAGEMENT SYSTEMS

INTRODUCTION

3.1. This Chapter will focus on the SMS as implemented within 501WG and any perceived weaknesses therein. It will be primarily based on the Spray Seal Program documents and witness statements, as this is the most recent program and largely sets out the extant system at 501WG.

3.2. In order to identify any weaknesses in the SMS, it will be necessary to look at the main areas under the regime in place at 501WG and the workplace issues within those areas, and how effectively the SMS is implemented and applied within those areas. The areas considered are:

a. Policy;

b. Structure;

c. Procedures;

d. Training;

e. Implementation; and

f. Audit & Review.

POLICY

3.3. WGCDR Brett Wood, who was until recently, the Director Safety Management (Air Force) states:

3.4. ‘At unit level policies are rarely read. Policies are voluminous in number and in content making them hard to read. …. they are not specific and they are not directions to act. Policies are not being written clearly to provide advice or direction to personnel in the workplace’[1].

3.5. The most relevant policy document at tactical level is the 501WG Policy Statement (Attached hereto as Annex A to Chapter 15). The sponsor of this Policy, dated 1 May 1998, is Group Captain Sargeant, then OC 501WG. The stated aim of the Policy is for 501WG to manage and conduct its operations in a manner that eliminates or minimises all hazards to

[1] MAN.0113.001, Witness Statement of WGCDR Brett Wood, at page 9 pars 26-27.

the environment and provides a safe and healthy workplace. The Policy states a number of means to achieve this aim, inter alia:

a. to apply EMOHS principles based on the standards-ISO 14001 and AS/NZS 4804;

b. to comply with Federal, State and local EMOHS laws;

c. to identify, prioritise and control activities impacting upon EMOHS; and

d. to ensure 501WG employees possess the necessary skills and appropriate training to meet their EMOHS responsibilities.

3.6. There is no mention of any specific resource allocation for OH&S, nor is there any reference to DSMA. Reliance seems to be placed on compliance with ISO14001 and AS/NZS 4804 as the means of achieving the stated aims of this Policy Statement. The difficulty with this is that ISO14001 and AS/NZS 4804 provide little direct guidance in and of themselves, to Commanders and subordinates in managing and conducting the elimination/minimisation of hazards within the Wings operations. These publications are not designed for this purpose; they are general in nature. This again reinforces the statement made by WGCDR Brett Wood as to the lack of specificity in policy.[2]

STRUCTURE

3.7. The Safety management structure at 501WG is set out in brief detail below.

OC 501WG

(501 WG Standing Instructions)

EMOHSO

QMES

AMF SRLM EMF AVMF

Quality Managers

(F L I G H T P R O C E D U R E S)

(BENCH LEVEL INSTRUCTIONS (BLI) and F O R M S)

3.8. There is an overriding system of 501WG Standing Instructions (SI), which outlines safety procedures down to Flight level. The OC and the CO's are to have meetings with the EMOHSO and QMES (Quality Manager - Environmental Systems) on a regular basis where OH&S and QM issues are discussed. This is known as the Quality Steering Group. Each

[2] MAN.0113.001, Witness Statement of Brett Wood.

Flight also has a Quality Manager (QM), who wears two hats, both of QM Auditor and OH&S Auditor. There is also a system of safety committees that run through the Wing.

3.9. THE QMES is also the Designated Manager for all 501WG SIs. His department maintains a list of all valid SIs, all of which are available on the Intranet. The system for BLIs is slightly different with BLIs maintained at Section level and not on the intranet as yet.

Committees

3.10. 501WG SI (PERS) 60-10-1 **-** Environmental Management and Occupational Health & Safety (EMOHS) Responsibilities.

3.11. Designated Work Groups (DWG). In line with the *OH&S Act*, groups of Australian Public Servants from the same work areas are to form these work groups. From each DWG a *Health and Safety Representative (HSR*) is to be selected to attend EMOHS committee meetings.

3.12. The OC of 501WG is responsible for the implementation of both the *OH&S Act* and RAAF Policy, and to ensure that sufficient resources are available to achieve this. Responsibility is then delegated down to the Commanders of each Section. COs are responsible for:

a. Appointing a Squadron EMOHSA (Environmental Management Occupational Health and Safety Adviser);

b. To ensure that all OH&S personnel (HSRs, EMOHSAs etc) meet at least quarterly;

c. To ensure that regular assessments of OH&S systems, performances and resources take place;

d. To ensure the training and supervision of employees; and

e. To ensure that all incidents are reported and recorded.

3.13. The SI sets out the responsibilities of Officers, Warrant Officers, Senior NCOs and the civilian equivalents. The WING EMOHSA is to monitor OH&S in 501WG providing a channel for information on OH&S matters to flow from the workplace to the OC.

3.14. The function of Health and Safety Committees is detailed as follows:

a. To assist the employer to develop and implement measures to protect the health and safety of employees;

b. To review and update such measures; and

c. To assist the employer in the dissemination of OH&S information.

3.15. Workplace Committees are required to report through their chain of command.

3.16. According to GPCAPT Sargeant, who was the Wing OC at the time, these safety committees were working in a vacuum in terms of training and resources[3].

Analysis

3.17. The *OH&S Act* 1991, Section 24, requires the formation of Designated Work Groups. DI (AF) PERS 60-10 states that Designated Work Groups and Safety Improvement Teams should meet at least quarterly. The BOI Database (all discovered documents) has no

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[3] Transcripts\Feb28.doc - SARGEANTTranscipt of Proceedings. GPCPT R.J. Sargeant at page 47.

record of any DWG meetings. However there is evidence of Health and Safety Representatives (who were to represent DWGs) attending some of the Wing EMOHS meetings[4].

3.18. Since the formation of Safety Improvement Teams in November 1996[5], there is evidence of one meeting for 501WG Aircraft Maintenance Flight (AMF) section on 21 May 1998. It makes reference to a previous meeting being held 12 months prior[6]. There are no other documents, currently held, to support the fact that any further SITL meetings took place.

3.19. Further, DI (AF) PERS 60-10 provides that SITLs should attend their respective Wing/Squadron/Unit OH&S meetings. The attendance lists from minutes of meetings, indicate that SITLs did not attend the Wing EMOHS meetings[7]. Sgt Orwin, supposedly a member holding the title of SITL[8], reports that he had never heard of a SITL before being questioned for the purposes of the Board of Inquiry[9]. Further he claims that he was never informed of the appointment and in fact was not aware of anyone else in the section who had any role which could be described as akin to that of a SITL[10]. It seems apparent that Safety Improvement Teams and the position of Safety Improvement Team Leaders were not well maintained SMS components. Considering the importance of the tasks SITLs were charged with (risk assessments of hazardous chemicals and control measures such as PPE, etc) the effect of not having anyone filling this appointment seems significant in terms of maintaining a safe working environment.

3.20. Since 1997, EMOHS meetings have taken place fairly regularly. While not strictly adhering to the quarterly provision (outlined above), EMOHS meetings were held approximately every 3 to 5 months[11].

3.21. After 1997, attendance lists taken from the minutes indicate that the OC 501WG did not attend 501 WG EMOHS meetings[12]. The OC has direct responsibility, established by the *OH&S Act*, and set out in DOHSMAN, DI (PERS) 60-10 & SI (PERS) 60-10-1, for ensuring:

a. That a safe and healthy working environment is provided for all workers within his command; and

b. That the agreed procedures for regular consultation between management and those with designated and elected health & safety roles are followed.

3.22. SI (PERS) 60-10-1 actually identifies the OC as a person who is to be a member of the Committee. While the SI does suggest that an OC may send a representative in his/her absence, all those persons actually attending the meetings were members also required by the SI to attend in their own capacity. It is surprising then, in light of these responsibilities, that the OC did not/could not take the opportunity to be present at perhaps, the most relevant forum for OH&S within his command, the WING EMOHS meeting. It should be

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4 AMB.0163.028, Minutes of the 501WG Environmental Management and Occupational Health And Safety Committee Meeting Held on Thursday 25 Sep 97; AMB.0158.047, Minutes of the 501WG Environmental Management and Occupational Health And Safety Committee Meeting Held on Thursday 25 Sep 97

5 AMB.0116.075. Minutes of The 501WG Aircraft Maintenance Flight (AMF) Safety Improvement Team Leader (SITL) Meeting Held 21 May 98

6 AMB.0116.075, Minutes of The 501WG Aircraft Maintenance Flight (AMF) Safety Improvement Team Leader (SITL) Meeting Held 21 May 98

7 AMB.0158.091AMB.0163.099.

8 Table of Appointments 15 Mar

9 MAN.0006.001, Witness Statement of M W Orwin; at page 31.

10 MAN.0006.001, Witness Statement of M W Orwin; at page 34.

11 AMB.0163.023, AMB.0158.042, AMB.0163.017.

12 AMB.0158.042, AMB.0163.009, AMB.0119.147.

noted however that the OC was on the distribution list for the meetings minutes, and so it may be assumed that the information was available to him in this way.

501WG SI (PERS) 60-10-2 - Wing EMOHS Management Review

3.23. This SI outlines the management review process, which involves the assessment of EMOHS system performance. This is done chiefly through audits. Two committees work together to affect this review. The EMOHS Management Review Committee acts in an advisory capacity focussed on continuous improvement. Members of the committee include the 501WG EMOHSA, HSRs, Squadron EMOHSAs and the OIC or a representative. The EMOHS Steering Committee has an active role in assessing and implementing the recommendations of the first committee.

Guidance

3.24. Guidance on the implementation of the SMS within the Wing could be obtained from sources within the wing or the Base, as well as from external sources. Within Amberley, the sources would have been the Wing EMOHSO, Medical Services and the Environmental Health Flight. External sources for guidance would include DSMA, SCA, Defcare, Comcare and any external consultants who may have been used. Guidance on implementation could also have been obtained from the policy and the various Orders, Instructions and Publications (OIP).

3.25. The Aerosafe Report on Risk Management states as follows[13]:

> 'Within every range of policy or instruction documentation, guidance on procedures and processes associated with the policy should be outlined. Upon reviewing the policy documents presented by the research team, it was clear that not all policy documents provided this guidance'.

3.26. Group Captain Sargeant, OC 501 WG between 1997 and 2000 said very much the same thing during his evidence before the BOI[14].

> 'They provide a range of issues but they do not provide guidance on the full range of issues which need to be addressed in an OH and S system'.

PROCEDURES

Suitability

OH&S Procedures

3.27. The work performed in the Spray Seal Program involved confined spaces, dangerous work implements and hazardous chemicals. The work methods were set out in procedures, contained chiefly in AAPs, SIs and BLIs, which prescribed how tasks are to be carried out. These procedures form the core of the SMS with all other components aiming to either facilitate safe procedures or to check the effectiveness of these procedures.

Relevant SIs

501WG SI (ADMIN) 6-1-1 - Format Of Procedures

3.28. This SI is the 'how to' of formulating written procedures. It sets out the details needed to be included in any SI promulgated. These include:

a. Structure;

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13 F111 Deseal/Reseal BOI Risk Management Report, Apr 2001 at page 51 para 3.
14 Transcripts\Feb28.doc - SARGEANTTranscript of the testimony of GPCPT Sargeant, 28 Feb 01 at page 15.

b. Content;

c. Aim;

d. Authority;

e. Sponsor;

f. Scope;

g. Actual Instructions;

h. Essential Training;

i. Job Descriptions; and

j. Duty Statements.

3.29. Effectively, the SI is to include the - Who performs the procedure, where, when and how.

501WG SI (ADMIN) 6-2-1 - Management of Procedures

3.30. This instruction outlines the method of development, approval and implementation of procedures. The SI states that every member of 501WG is to be conversant with the instructions and procedures relevant to their area of responsibility. It outlines the method of dealing with superseded and obsolete procedures.

501WG SI (PERS) 33-3-1 - EMOHS Section Workplace Induction

3.31. The *OH&S Act* (1991) and The *Environmental Protection Act (1994)* require all 501WG personnel/contractors to be provided with advice and information to prevent injury to themselves and others and to preserve the environment. Thus, a Section Workplace Induction briefing must be undertaken. A Workplace Induction Checklist is provided in the SI.

501WG SI (LOG) 3-108-3-Safety Precautions for Fuel Tank Maintenance Preparation

3.32. All personnel involved in fuel-tank maintenance preparation activities are to be certified as 'competent persons' with regard to confined space entry (CSE). A certified person is considered to be a person 'who has, through a combination of training, education & experience, acquired knowledge and skills to correctly perform the task' specifically:

a. Has been assessed by a supervisor as competent to undergo CSE operations in the last 2 years, and

b. Is assessed as fully aware of the hazards involved and procedures required during all aspects of CSE operations.

3.33. The evidence concerning tradesmen's awareness of the hazard posed by the chemicals used, was:

a. 'We had no specific formal training about the chemical hazards'; [15]

b. 'There was definitely no instructions or training provided to us in relation to the handling or usage of chemicals';[16] and

[15] WIT.0518.001, Witness Statement of Brett Anthony Gibson
[16] WIT.0384.001, Witness Statement of Leigh Robert Mills

c. 'There was no confined space or OH&S courses at the time, there was no chemical training' [17].

3.34. The safe level of oxygen present within a fuel tank is stated as being between 19.5% and 23% (as per AS 2865). Outside this range, entry is prohibited. The Supervisors' Checklist includes the requirement to:

a. Ensure that personnel entering the tank are 'competent' & current in their CSE Training;

b. Check oxygen and LELs ;

c. Ensure that personnel are wearing the appropriate PPE;

d. Ensure that a risk assessment is carried out (form provided); and

e. Ensure that all personnel have read DI (AF) AAP 7027.001-1, DOHSMAN Chapter 7.

3.35. The evidence in this regard was :

a. 'It is my recollection that most people did not get to read the relevant publication properly and we simply relied on the people who had been there before to show us the correct procedures'[18].

b. 'I was not given any theoretical instructions when I joined the section with regard to fuel tank entry'[19].

3.36. The Senior Non-Commissioned Officer (SNCO) of FTRS from August 1999 until present time stated that to the best of his knowledge, *' there are no other publications and no bench level instructions relating to the [Spray Seal] program'* apart from 3 AAPs (7027.001.1, 7214.001.292-5, 7214.003.1-281. Despite the evidence of lack of awareness there was in fact a number of relevant and current DIs, SIs and BLIs, which generally relate to the program and specifically to the procedures.

Relevant BLIs

3.37. 501WG FTRS BLI 06 – Sealant Injection (IOI.0017.017): The BLI provides instructions on the use of the Semco sealant injection gun used for spray sealing. It contains fairly detailed instructions on the proper use of the gun. It does mention the PPE to be used, ie safety glasses and gloves but no mention is made of the type of gloves to be worn.

3.38. 501WG FTRS BLI 07 – Injection Gun Cleaning and Storage (IOI.0017.020): This BLI outlines the procedures used to clean the Semco sealant injection gun. It provides fairly detailed instructions of the actual cleaning process. It states that appropriate PPE is to be worn and the minimum PPE is safety goggles, respirator and gloves. No detail is given as to what respirator and what kind of gloves are to be worn. As MEK is used in the cleaning process, the type of glove worn would be fairly important.

3.39. 501WG FTRS BLI 09 – De-Puddler Usage (IOI.0017.023): Instructions on the use of the de-puddler for removing residual fuel from fuel tanks. The instructions are not very detailed and the only PPE mentioned is a full-face respirator.

Compliance

3.40. Compliance can be monitored in a number of ways, for example by way of an audit. In the case of audit, as is discussed elsewhere in this chapter, the means of

[17] WIT.0517.001, Witness Statement of Dean Ashley Cook
[18] WIT.0259.001, Witness Statement of PJ Ruth
[19] WIT.0221.001, Witness Statement of CJA Parker

monitoring compliance was inconsistent at best. In such circumstances, the monitoring of compliance fell very much to the trade supervisors and NCO (Non-Commissioned Officer) Supervisors.[20] There are weaknesses in this type of internal monitoring. Supervisors are subject to many of the same pressures that all the personnel are. For example:

a. pressure from above to meet deadlines which were at times reportedly, 'unrealistic'[21] ;

b. the availability of resources, especially PPE, in order to comply; and

c. workplace culture.

3.41. Thus, if the persons principally charged with ensuring compliance with procedures, are also subject to conditions of conflicting goals (such as timely performance and lack of resources) it cannot be said that an adequate or reliable system exists that ensures compliance.

3.42. Witnesses from 'shop floor' to supervisory levels have identified a number of examples of non-compliance. There are many possible reasons for non-compliance.

3.43. L R Mills cites 'obscurely written' instructions as a causal factor in non-compliance. He further commented that in his opinion, non-compliance existed as a result of confusion rather than a lack of enforcement[22]. In accord with this, M W Orwin believes that the spray seal procedures were 'inadequately understood' and 'inadequately planned'. One plausible explanation of non-compliance is that personnel simply did not always understand the procedures they were required to follow. The impractical nature of some written procedures is also a possible explanation of non-conformance. To highlight such an instance, it has been reported that certain prescribed gloves were not worn because they deteriorated so rapidly and it was not considered worth using them[23].

3.44. Time-pressures are also cited as a reason as to why non-compliance may have occurred. It is reported that the engineers determined the 'turn around' times and these were often, simply unachievable without compromising health and safety[24]. Many witnesses report that there was an overwhelming emphasis on completing each aircraft spray seal as soon as possible. W.H. McClymont suggests that it is because of these time frames that 'procedures could vary from aircraft to aircraft particularly if there were problems with PPE availability'[25].

3.45. Such 'procedural variance' is most likely to have constituted non-compliance. An example of this is personnel entering the Fuel Tanks without the appropriate PPE due directly to time constraints:

a. 'There is pressure from upstairs to get the job done. At one stage they were found to have ordered the wrong booties. Management would not delay the work';[26]

b. 'The attitude of management: get it done! They have done sealant spraying without booties, with paint shop ventilation and the air-conditioning turned off;'[27] and

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20 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings. R J Sargeant. 28 Feb 01 at page 50.
21 MAN.0006.001, Witness Statement Mark William Orwin, at page 18.
22 WIT.0384.001, Witness Statement of L R Mills at page 4.
23 WIT.0120.001, Witness Statement of Steven Douglas Grant, at para 12-13.
24 WIT.0189.001. Witness Statement of William Hugh McClymont.at para 31.
25 WIT.0189.001. Witness Statement of William Hugh McClymont.
26 EXP.0001.001501Wg F111 Fuel Tank Spray Sealing Investigation:Interim Occupational Medicine Report; WGCDR J Ross.Interview of CPL Dean Saunders at page 26.
27 EXP.0001.001501WG F111 Fuel Tank Spray Sealing Investigation:Interim Occupational Medicine Report; Interview of William McClymont at page 28.

c. 'If the PPE was inadequate…you were told just to get on with it…could not afford the time to get equipment repaired'[28].

3.46. Resources, or more accurately the lack of resources to fund adequate and available PPE, directly affect the ability of personnel to comply with written instructions. Examples may be found in:

a. Personnel not renewing/replacing PPE at specified regular intervals due to financial constraints[29];

b. Prescribed PPE was not available; and

c. 'If the PPE had not been provided…then you just had to make do with what you had…the Section could not afford to purchase extra PPE'[30].

3.47. There is the danger of non-compliances being institutionalised into general practice over time, obscuring after a period, what activities are compliant and what are not.[31] This is especially true of work-places which rely heavily on the provision of information and processes to new recruits via on-the-job training.

3.48. Whilst non-compliance itself may be viewed as a failing of a Safety Management System, the underlying reasons attributable to such non-compliances are, perhaps more imbued in the organisation and therefore serve to highlight a number of more significant failures.

3.49. The first of these failures is the inadequacy of the procedure itself. If unqualified persons were developing the written procedures or the resultant procedures were confusing or insufficiently detailed, this cannot be seen as conducive to providing informed efficient and safe instruction for personnel to follow. Various witness statements have referred to inadequate and confusing procedures.

3.50. Secondly, with the emphasis strongly placed upon operational targets set by management, which numerous witness statements and expert reports referenced in this Report attest to, safety is often the first corner to be cut. The imperative of establishing a Safety Management System is undermined by an organisational culture, which is overwhelmingly focussed on a 'job-first' attitude with safety being considered a luxury. Such an attitude does not follow on from the ADO Policy statement which provides that operational readiness and safety are not at odds with each other as the maintenance of safety within the Defence force actually promotes operational readiness through financial and morale advantages.

Personal Protective Equipment (PPE)

PPE Ordering

3.51. FSGT Murphy[32] 'If not on the approved RAAF list, the procurement sections request to him. Also, local purchase for PPE is supposed to come through ENVH section but no procedures were actually written to direct this to happen. For Electronic Purchase by Unit, there is an 'arrangement' between the EPU system manager and EHS to refer PPE orders. However, there could be purchases of approved PPE for inappropriate tasks. There is no linkage between PPE and the process the PPE is used in'.

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28 WIT.0015.001, Witness Statement of Shawn Patrick Anderson at para 19-20
29 WIT.0047.001, Witness Statement of Claudio Christopher Cecere, at para 34.
30 WIT.0015.001 Witness Statement of Shawn Patrick Anderson, at para 19-20
31 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings. R J Sargeant. 28 Feb 01, at page 50.
32 EXP.0001.001Interim Occupational Medicine Report, WGCDR Ross; Apr 2000, at page 20; Interview with FSGT Murphy.

3.52. CPL Dean Saunders[33] 'He found that there was no record of servicing on Sabres (supplied air). All were out of date: he brought this up with the SGT. There was something of a confrontation. CPL Saunders initially refused to get in and spray. Eventually he did, and following this, maintenance was done and recorded. He feels hierarchy did not support him enough, and he was fully within his rights to have refused to work with Sabre units for which maintenance records were not available. At one stage they were found to have ordered wrong booties. The Section was doing its own ordering, and fell behind. They had to rig up booties themselves. Management would not delay the work. Now they keep three to four sprays ahead for PPE'.

TRAINING

3.53. Witness statements indicating that there was no formal training in place for the spray sealant program:

> 'The only training was on the job. We trained new members and let them learn from everyone to gain as wide an experience as possible. There was nothing ever written down.'[34]
>
> 'I had previously carried out Fuel Tank Repairs when I was at 482 Squadron in about October 1998. I had been given on the job instruction at the time. I was shown how to it was done, I was supervised while I did a repair and then left to carry out repairs myself'[35].
>
> 'It is my recollection that most people did not get to read the relevant publication properly and we simply relied on the people who had been there before to show us the correct procedures[36].

3.54. However, another witness has stated that training, at least for the trial, was undertaken within the section by two Americans who imported their experience from SM-ALC:

> 'I was present during the trials conducted in conjunction with the Americans for the new Spray Seal Program. The purpose of the trial was to teach the section the new American Spray Seal method. I recall that two American civilians were here for about two weeks and both were in their mid-30s. Trials were conducted by two American workers. They brought with them a range of safety equipment and PPE including spray guns, gloves, Sarnex suits, cool suits, ventilation equipment, Sabre breathing apparatus, etc. The demonstration training took place in the Paint Shop hangar and all members of FTRS attended. They gave us a bit of a talk about the process.
>
> I particularly remember the Americans warning us about the primer used in the process, which was a green colour. They told us that it contained minute metal particles and could damage our lungs. I recall that there was a warning on the container that said that it could damage your lungs, kidneys and other internal organs. It could also cause skin irritation.[37].

3.55. This witness then stated that the Americans also advised them on general procedure, use of PPE and the type of PPE to use, requirements for the babysitter, the sabre equipment and the method for mixing the sealant[38].

3.56. This was also confirmed by Mr Joiner who advised:

> 'About two weeks after my arrival at FTRS, I took part in a trial spray seal. This was conducted by two Americans who had been conducting spray seals for the United States Air Force. There were two Instructors and both of them were very experienced in the spray

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33 EXP.0001.001Interim Occupational Medicine Repor, WGCDR Ross Apr 2000, at page 26, Interview with CPL Dean Saunders
34 WIT.0052.001, Witness Statement of Glenn Stewart Carmody (fmly Cpl) Mr Carmody was Quality Assurance Manager during the spray sealant phase and was responsible for writing the Quality Assurance Manual during that period.
35 WIT.0380.001, Witness Statement of Cpl Bradley John Frohloff.
36 WIT.0259.001, Witness Statement of Cpl Peter John Ruth posted to the FTRS Mar 1999 until present.
37 WIT.0113.001, Witness Statement of Graham Phillip Gallagher at paras 8-9.
38 ibid at paras 10-11.

seal procedure. One of them informed us that he had been doing the spray sealing procedure for many years'[39].

3.57. This is further supported by another witness who advised:

'At some time, maybe 1996, two persons, contracted civilians to USAF, came to Amberley to instruct FTRS on the new spray seal process. They were here for two weeks. When the two Americans were at Amberley, to my knowledge, the Australian Government had not made a decision on buying the spray seal program. The Americans lectured us, demonstrated how it was done… Approximately twelve months after that two-week visit our unit started using the system, and obviously at some point in between we had agreed to buy in this fuel tank maintenance program.

When I started to do the spray seal work, there was no further instruction from anyone from the United States, nor any formal instruction from anyone in the RAAF. At this time, twelve months after the visit, there were four remaining RAAF members who had been on site when the US persons visited and trained us. Two of the four of us were promoted in the intervening period. I became a trade NCO, a Corporal. Corporal Ohmsen was the other who was promoted in this time. Both Corporal Ohmsen and myself were directed by our supervisor, Sergeant Sandham, to instruct those AC's and LAC's under us on how to do the task'[40].

3.58. A minute of July 1996 notes that management was undergoing a significant restructure and as such it was noted that the '*OHS For Managers*' or '*OHS3- Managing Heath & Safety in the Workplace*' had become pre-requisites to complete the revised EMOHSA course[41].

3.59. A Minute written by CPL Bannister in February 1994, notes that, though he had completed the confined space entry course, he received no practical knowledge in the use of meters, air conditioning units or breathing apparatus[42]. CPL Bannister wrote to the ENVHO with the suggestion that the course should be amended to include the necessary training.

3.60. Then, in 1995 it was recommended by ENVHO that, in line with the recent developments in Australian Standards and Codes of Practice:

'…units who conduct their own training should ensure that the content of the training and the competency levels to be achieved are assessed by the PMO's office. This assessment is necessary to ensure that all training courses are equivalent, meet the requirements for EDP reporting, and are reviewed periodically IAW Reference D…. DI (AF) SAFETY refers to the previous Australia Standard and is no longer current'[43].

3.61. It was proposed in 1997 that courses be developed for both manual handling and hazardous substances to facilitate education of the *OH&S Act*, Regulations and National Standards and to ensure compliance with that legislative structure[44].

Confined Space Entry Procedures.

3.62. One witness has observed that as at 1996 there was no fuel tank entry course.

'Our FTRS section also developed the confined tank entry course that was run by Training Flight from about 1998. As at 1996 there was no fuel tank entry course. It was decided by

39 WIT.0382.001, Witness Statement of Heath Ashley Joiner at para 5.
40 WIT.0052.001, Witness Statement by Glen Stewart Carmody at paras 30-32-33.
41 AMB.0008.185, OHS Training for Occupational Health And Ground Safety Coordinators dated 1 Jul 96
42 AMB.0008.219, Confined Space Entry Course, 16 Feb 94
43 AMB.0043.055, Confined Space Entry Training dated 13 Oct 95
44 AMB.0008.001, Occupational Health and Safety Training For Manual Handling and Hazardous Substances dated 3 Feb 97

> my supervisor that new members posted to FTRS receive on the job training from our section SNCO's and NCO's. When they were posted out to other units it was hoped they would spread the knowledge'[45].

3.63. One member has advised that he completed a Confined Space Entry course in both 1997 and 1998.

> 'I previously completed a Confined Space Entry Course conducted by FTRS on 18 June 1997. The later course was much more comprehensive then the earlier course which apparently did not comply with relevant Australian Standards'[46].

3.64. SQLDR Beighton states that in late 1995 there was no confined space training course at Amberley although there was a course at Laverton[47].

3.65. As late as 27 March 2000, the Confined Space Entry Procedures training course was being further refined. In a Minute issued by 82WG, it was advised that the course had been authorised for delivery on 31 August 1998 following investigation and development by TTS staff, however, they were still seeking national accreditation.

> 'The course was developed to meet the current Australian Standard AS 2865-1995; the Defence Occupational health and Safety Manual (DOHSMAN); MSDS data sheets; DI(AF)AAP 7027.001-1; and relevant DI's and AAP's.'

3.66. and further

> 'In summary TTS are confident that the CSE training meets all the requirements of the current Australian Standards and air publications. PPE used during the course meets the requirements of the fuel tank environment encountered on the F111 training Aircraft'[48].

Hazard Management Training

3.67. The Defence Safety Management Agency (DSMA) produced the 'Managing Occupational Health and Safety' participant's manual for training purposes. The *Workplace Safety Management* participant's manual June 2000 appears to have a comprehensive coverage of chemical and hazardous substances. This course combines the previously separate training instructions 'Working Safely' and 'Hazard Management', into one training program. It contains 5hrs and 20mins of training in the control of specific hazards including chemicals and hazardous substances. It is uncertain as to how much time is actually concentrated on chemical hazards The course material provides definitions relevant to hazardous substances, legislative requirements, and the dose factor pertaining to chemicals and their exposure in the workplace[49].

3.68. It provides general knowledge about the importance of risk assessment associated with the chemical used to determine the dose level (amount of a substance that is absorbed) and the importance of this exercise. The MSDS is covered as well as the manufacturer, supplier and employer's duties. The course goes in to some detail about the maintenance of the Hazardous Substances Register and the structure for risk assessment of hazardous substances. The training material provides information on hazards that may be associated with respiratory protection. The course does provide an awareness of the importance of the

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45 WIT.0052.001, Witness Statement of Mr Glenn Stewart Carmody.
46 WIT.0273.001, Witness Statement of Dean Andrew Saunders at para 11.
47 MAN.0028.001, Witness Statement of Pal Beighton dates 18 May 2001 page 12 par 30 (ii)
48 82WGGTTS/57/3/2203/AIR Pt 1(66).
49 Department of Defence Workplace Safety Management Participant's Manual June 2000 Section5.3 to 5.3.10.

management of hazardous substances in the OH&S system, but it could be tailored more towards meeting the practical needs of work units such as 501WG.

3.69. There is a voluntary course designed for Commanders, managers and other senior officers titled *Managing Health and Safety in the Workplace* that commenced in December 1998. This training course covers the basic knowledge of hazardous substances. It focuses on the general requirements for hazardous substances and the penalty for non-compliance with the Regulations[50]. The training was generic in nature and did not include chemical management training.

IMPLEMENTATION

Resources

3.70. There is no doubt that the sufficiency of resources has a vital role to play in whether a SMS can be effectively implemented or not. There are numerous witness statements referred to throughout this report that cite a lack of resources as a problem with respect to PPE, training and other important elements of a SMS.

3.71. One of the necessary elements of an effective SMS under Chapter 13 is a separate or distinct budget allocation for Health and Safety. This does not appear to be the case in the RAAF. There are numerous examples from the witness statements and hearing transcripts where the lack of resources, whether financial, human resources or otherwise, have been cited as the reason why some aspects of the SMS system were neglected or delayed or bypassed. According to Geoff McDonald:

> 'Believes an assessment of the lack of resources (eg finance, staffing levels) on safety has not been made'[51].

Process of Implementation

3.72. The SMS is implemented in 501WG through the RAAF system of Orders, Instructions and Publications. The most relevant of which are Standing Instructions and Bench Level Instructions.

a. **STANDING INSTRUCTIONS** (SIs) – Standing Instructions are the tools by which legislative policy and higher order instructions are implemented at Wing level and below.

b. **BENCH LEVEL INSTRUCTIONS** (BLIs) – Bench Level Instructions are those instructions that devolve further down from Wing level and which are formulated with regard to Flight/Unit specific matters.

501WG SI (LOG) 16-1-1 - Management of Hazardous Substances

3.73. This SI sets out relevant definitions, responsibilities and requirements concerning the management of hazardous substances for both short and long term contractors, Squadron COs, EMOHSAs and SITLs.

3.74. Safety Improvement Team Leaders (SITLs) are charged with:

a. Responsibility for the Inventory of Substances (required to be maintained) in the section;

b. Risk Assessments of Hazardous Substances;

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50 Department of Defence Managing Health and Safety in the Workplace December 1998: Section4.3.0-4.3.1.

51 The Geoff McDonald Class 1 Damage Control Strategies Report dated 26 Mar 01 at page 209

c. Obtaining current MSDSs; ['No one knows whether in fact the Material Safety Data Sheets are accurate or the frequency of their updating'[52]];

d. Determining risk control measures with other team members; AND

e. Ensuring the labelling of hazardous substances are in accordance with NOHSC: 2012 (1994) and ensuring the Amberley Fire Officer is involved in determining the necessary stores for Dangerous Goods; and

3.75. Environmental Health Services are required to provide SITLs with:

a. Health surveillance advice;

b. Air Contaminant monitoring advice;

c. Hazardous Material Spills advice; and

d. Risk Assessment, PPE and MSDS advice.

3.76. SITLs were charged with these responsibilities even though it is fairly obvious that SITLs did not have the same extent of knowledge, expertise and qualifications that the Environmental Health Services (who were to provide only 'assistance' and 'advice') possessed. In his statement, 501WG EMOHSO Hal Waddington says that:

> 'SITL courses were only run when there were sufficient numbers to make it economical to do so', thus 'it was possible for a person to fill a SITL position until they were re-posted without ever having completed the appropriate training'[53].

3.77. Considering the importance of the tasks SITLs are charged with (risk assessments of hazardous chemicals and control measures such as PPE, etc) the repercussions of having untrained personnel attempting to fulfil the above, can be seen as directly compromising the health and safety of personnel.

3.78. Under the *OH&S Act*, DOHSMAN, and specifically stated in 501 WG SI (PERS) 60-10-1, Commanding Officers are responsible for ensuring that employees are appropriately trained. The fact that this was apparently not achieved in practice, highlights a further failing in the system. One reason cited for the lack of training is economical considerations. This suggests that OH&S might not have been considered a high priority, in that appropriate and necessary funds were not allocated and/or utilised. It is not clear at what level this lack of funding originates, at tactical level , where insufficient funds were provided or at strategic level were insufficient funds were allocated for safety.

3.79. This instruction provides that Commanders are responsible for implementing the procedures. They are responsible to Ensure MSDS for all hazardous substances are obtained and made available to employees. Some witness statements indicate problems with comprehension of the MSDS as indicated below:

> 'No one really knows how to interpret some of the MSDSs'[54] and 'The MSDS were very vague….the information was difficult to comprehend' [55].

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52 WIT.0384.001, Witness Statement of L R Mills at page 7.
53 MAN.0007.001, Witness Statement of Hal Waddington, 501WG EMOHSA, at para 63.
54 WIT.0384.001, Witness Statement of L R Mills, at page 7.
55 WIT.0007.001, Witness Statement of C D Allen, at para 12.

> 'However there is no training provided to members of sections on interpreting the information, it is assumed that the information is understood and capable of action. Interpretation of the technical data provided on a MSDS at the workplace is a difficult issue and one that the legislation does not address'[56].

Conversely,

> ' I think the Chemwatch system (for the sourcing of MSDS) has been selected to provide the technical data in a number of formats which makes interpretation a more simple process'[57].

a. Ensure that all containers that hold a hazardous substance are appropriately labelled;

b. Ensure that all sections hold a Register of Hazardous Substances. The Register is to be compiled by all Squadrons and Flights with Work areas. Some of the witness statements indicate that the requirements under this SI were not met:

> 'I do not recall there being a chemical management system, and there was no inventory of chemicals kept that I was aware of'[58].
>
> 'The only management system relating to the chemicals was an inspection for expiry date before use and ensuring that they were stored either at 501WG Sealant Section or in the fire lockers located at FTRS'[59].
>
> 'The only management of chemicals that I was aware of was in relation to the sealant. You would have to go to the sealant section, request the amount and then sign for it'[60].
>
> 'To my knowledge there was no management system in relation to the chemicals'[61] and 'There was a relaxed attitude from my direct supervisors about the chemicals'.

d. Ensure a risk assessment is undertaken to determine if there is a risk to health where there is potential for exposure to a hazardous substance. The assessment can aid decisions about appropriate control measures, training, monitoring and health surveillance;

e. Ensure adequate control measures are implemented to prevent exposure or minimise the risks to health caused by the hazardous substances;

f. Appoint to each workplace a Safety Improvement Team Leader (SITL) to be responsible for Environmental Management, Occupational Health and Safety duties; and

g. Ensure EMOHS training, and requirements are incorporated into work processes, procedures and BLIs.

Beryllium / Beryllia 501WG SI (LOG) 16-1-2

3.80. This instruction states that individual squadrons have the responsibility to draft BLIs (Bench Level Instructions) identifying risks and control measures. In respect of

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56 MAN.0028.001, Witness Statement of Paul Beighton dated 18 May 2001 page 13 par 31
57 MAN.0028.001, Witness Statement of Paul Beighton dated 18 May 2001 page 13 par 31
58 WIT.0384.001, Witness Statement of L R Mills, at para 49.
59 WIT.0015.001, Witness Statement of S P Anderson, at para 50.
60 WIT.0377.001, Witness Statement of G R W Bennett, at para 40.
61 WIT.0379.001, Witness Statement of A S Dixon, at para 58.

Beryllium / Beryllia the SI lists the chemical as highly toxic and extreme caution should be exercised in its handling. It then goes on to outline only two provisions:

a. To use rubber gloves (non-specific in brand and rate of replacement); and

b. Do not inhale the toxic fumes.

3.81. The SI however, mentions nothing of training or personnel competency.

Handling MEK 501WG SI (LOG) 16-1-6:

3.82. This SI outlines how to handle and store MEK and what to do if spillage occurs. The instruction also goes into detail about the most suitable way to dispose of the chemical and what the most appropriate First Aid procedure is for an accident. It states that protective glasses and eye protection must be worn when handling MEK[62]. Gloves are only mentioned in connection with the burning off of MEK and not with respect to normal handling. This seems to be a deficiency as the SI states that MEK should not be brought in contact with the skin.

Hazardous Material Spills 501WG SI (LOG) 9-2-2:

3.83. This SI outlines procedures to be followed in the event of a hazardous spill. A Hazardous Material Spill Kit is to be stored on site as well as a Quick Response Trailer (equipped with absorbent matting etc). The EMOHSA is to be the Hazardous Material Spills Officer.

Waste Management 501WG SI (LOG) 16-1-7.

3.84. Sets out the responsibilities for EMOHSAs, SITLs, Team Leaders and 501WG Quality Steering Group with regard to waste management. A Waste Management Checklist is provided

3.85. The SI stipulates that the Team Leaders and EMOHSA's determine the need for specialist analysis of the Section's waste stream components and suggested solutions to problems identified. The SI states that the team leader is to enlist team members, SITLs and EMOHSA's to document plans in 501WG SI(ADMIN) for avoiding, reducing, reusing and recycling waste in their section. Once completed, the electronic format is to be forwarded to the Squadron CO through the Flight OICs and EMOHSA's.

3.86. It is the responsibility of the Squadron COs and Flight OICs to review the 'Waste Management Checklists' and management plans with EMOHSAs, and for the CO to present the completed review to the 501WG Residual Quality Steering Group meeting. The 501WG EMOHSO is responsible for reviewing the Contractors waste management plans for compliance, and to ensure 501WG Residual management system is continuously improved[63].

Relevant BLIs

3.87. The Bench Level Instructions (BLIs) for 501WG appear very brief, particularly on how to handle chemical applications in the technical procedures. They provide basic chemical management knowledge such as the storage, labelling and waste management applicable to the chemicals used in the work unit. There are some instructions about using PPE for certain work procedures and some generic warnings on what not to do in the presence of toxic chemicals[64]. However, there is no information about health surveillance, or how exposure may occur eg, inhalation, absorption through skin, and what

[62] 501WG SI(LO) 16-1-6; 01 Nov 97.
[63] 501WG SI(LOG) 16-1-7 Section, 11-14; 12 Aug 99.
[64] 501WG-ASRS-BLI-03 Sealants, Composites And Adhesives Storage Section: Undated/ AMF TOOLSTORE BLI 06 Management Of Hangar 410 Toxic Waste Facility: 07 September 2000/ 501WG SURFIN BLI 10 Surfin Chemical Waste Management; Undated/ 501WG-ASRS-BLI-13 MEK Handling Procedures; Undated.

effect it has to health. The BLIs do not emphasise the possible danger of toxic chemicals to health and why it is important to develop safe work practices for minimising the health risk. The following is a list of 501WG BLIs related to hazardous substances (chemical) management system:

3.88. **AMF TOOLSTORE BLI 06**. Management of Hangar 10 Toxic Waste Facility. Outlines procedures to use when disposing of toxic waste. Very brief and just states whom to contact to dispose of the waste.

3.89. **501WG SURFIN BLI 10 SURFIN**. Chemical Waste Management. Contains what seem to be fairly detailed instructions for the storage and disposal of chemical trade waste.

3.90. **501WG ASRS BLI 13 M.E.K**. Handling Procedures. Sets out the procedures to be followed when handling MEK. Lists the PPE to be used as well as the surrounding area that needs to be cordoned off when using PPE.

3.91. **501WG-ASRS-BLI-03**: In relation to: Sealants, Composites And Adhesives Storage Section.

Facilities

Rust PPK Audit (1996)

3.92. Between November 1995 and April 1996, an external agency, Rust PPK undertook a visual inspection of the facilities at Raaf Base Amberley. Eight hundred (800) hazards were identified for 501WG.[65] Hazard items included storage drums of solvents and liquid waste being stored inappropriately, inadequate ventilation, insufficient shower/change-room facilities and the possible contamination of the nearby creek[66]. Hazards were given a priority rating and an estimated cost of correction in the report.

3.93. Minutes of the 501WG Unit Occupational Health and Ground Safety Committee (July 10, 1996), reports that 'approximately 10-15% of the 800 hazards have been rectified', 3-4 months after the audit was conducted. Sections had been advised to attend to any hazards that were of nil cost or labour cost only, or otherwise within their own financial capability[67]. These corrective actions perhaps account for the 10-15% of hazards that were rectified. It is difficult to trace any further follow-up or corrective action as the Committee structure changed in 1996 and EMOHS meetings commencing in 1997 did not seem to pick up from where the Base Ground Safety Meetings left off[68]. Considering that the total estimated cost of correction was $1, 721, 298, it is likely that this figure was beyond the budgetary capacity of 501WG, and no further actions were taken with regard to implementing the recommendations of the Rust PPK audit.

Woodward Clyde Audit

3.94. The Woodward Clyde audit was an OH&S environmental management facilities audit commissioned in late 1997/ early 1998 to identify all the aspects of 501Wing facilities that required rectification prior to the commencement of market testing. The Woodward Clyde Report identified $2.6 million worth of facilities deficiencies. GPCPT Sargeant states that money was simply not available to rectify such issues[69].

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65 Folder AMB.0109.

66 AMB.0109.028, Details of Ess OH&S Hazards at pages 7,18,19 dated 1 Aug 96

67 AMB.0109.021, 501 WG FACILITY OH&S HAZARDS - RUST PPK AUDIT dated 1 Dec 96, AMB.0109.052. Rust PPK Audit dated 24 Jul 96

68 AMB.0068.048, AMB.0158.153.

69 Transcripts\Feb28.doc - SARGEANTTranscript of Proceedings, GPCPT R J Sargeant, 28 Feb 01 at para 51.

3.95. The Rust PPK and the Woodward Clyde Audits were commissioned and then subsequently the findings and recommendations with regard to rectification of identified hazards were unable to be followed up on apparently due to limited resources. This seems to defeat the purpose of funding an external audit process in the first instance.

Ventilation

3.96. The Ross Report states as follows[70]:

> 'The ventilation system in the paint shop hangar is designed for the surface finishing of aircraft. As such, when operating, it should effectively remove contaminants from the hangar. At present, it is not known how effective the system actually is. The air is pulled out and vented to the atmosphere several metres above the ends of the eastern wall of the hangar. It is not known weather the extracted air in suitable wind conditions, taken into the supplied air compressor. This ventilation survey should be undertaken as part of the investigation.
>
> The ventilation system is not able to deal with contaminants in a confined space, such as the fuel tanks. Specific ventilation solutions are needed. The RAAF spray sealant procedure stipulates that a push/pull system be in place in all fuel tanks, with air flow rates clearly stated, (AAP 7214.003-292-5 Para 5). The exhaust hoses are also required to be in place for 48 hours after application of any of the chemicals in the resealing process. It appears that this has never been the case.'

Tank ventilation

3.97. WGCDR Ross states[71]:

> 'Tank ventilation was either not used at all, or a single extraction hose was used, as against the requirement for both supply and extraction ventilation for any tank being worked in as part of the procedure. This could contribute to much higher levels of contaminants in the tank environment. The tank environment is cramped, and particularly for the aft tanks, it is difficult to have all the lines coming in (water cooling, spray gun, light, air hose) and ventilation hose or hoses, and have the safety standby be able to see the worker. However, the USAF technical order made it plain that supply and extraction ventilation is required, with a flow of 250 fpm (feet per minute) in and 200 fpm removed. There should be a flow through from the supplied to the extraction hoses across the tank. A slightly higher supply than extraction will allow further air to escape from the tank at sites other than the extraction hose. It is also important not to have too high a flow rate to not cause a scattering of sprayed droplets inside the tank. This way will reduce the chemical levels inside the tank and chemicals escaping to the surrounding areas'.

Spray Seal Ventilation

3.98. The requirements for spray sealing ventilation are detailed in AAP 7214.003-292-5, and include that:

> '…all tanks being sprayed shall have two exhaust ventilation hoses and each adjacent tank shall have one exhaust ventilation hose…Each tank being sprayed must also have two supplied ventilation hoses'[72].

3.99. Paragraph 20 of the AAP details the placement of ventilation hoses during spraying. AAP 7214.003-1AUP lists the approved GSE for ventilating and purging F111 fuel tanks[73]. The DOSHMAN puts ventilation on a higher rank than PPE in the hierarchy of

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70 EXP.0001.001Interim Occupational Medicine Report, WGCDR Ross, Apr 00, at page 51.

71 EXP.0001.001Interim Occupational Medicine Report, WGCDR Ross, Apr 00, at page 46.

72 AMB.0041.001. Royal Australian Air Force Australian Air Publication 7214.003.292.5 Spray Sealing Of F111 Fuselage Fuel Tanks Dated 21 Jul 97

73 AMB.0102.084. Ventilation and Purging of F111 Fuel Tanks dated 1 Jan 99

engineering controls. The Armstrong Report (USAF) Industrial Hygiene Analysis of fuel tank deseal/ reseal process states that:

> ‘The constituents that make up the primer (especially toluene and MEK) present an extreme explosive hazard when sprayed in a confined space in fuel tanks. Further, the configuration of tanks, with multiple bays, offers a challenge for eliminating concentration pockets even with local ventilation. Fortunately, this can be overcome with dual push pull ventilation system, using pre-existing openings within the fuel tanks…’

3.100. The recommendations of the report are:

> ‘… to have a balanced tank ventilation system designed for this process, this must include a class 2 flameproof particulate filter, PPE, confined space entry rules compliance as mandatory, fuel tanks to be monitored prior and during entry for oxygen explosive levels[74]**.**’

3.101. Notwithstanding all the above regulations and recommendations, however, the evidence suggests that ventilation was not adequately and consistently applied throughout the spray seal program. Regulations were not complied with, and OH&S standards were ignored, in pursuit of an imperative of ‘operational readiness’.

3.102. Spray Seal workers had a strict timeframe within which to complete aircraft sealing. Spray seal turnaround times were reduced from two weeks to one week[75]. - Some spray seal staff went as far as to say that ‘…the engineers set turnaround times that were simply unachievable without compromising health and safety[76].’ With pressure from superiors, a culture of ‘must do’ imperative to ‘get the job done’, and a limited time frame - it seems that spray section staff had little choice but to ignore ventilation OH&S considerations in favour of completing the task.

The Functions of Ventilation During Spray Sealing

3.103. Documentation suggests that the function of ventilation, during spray sealing, was to prevent explosive potential:

> ‘Ventilation is used to control vapours and aerosols produced during the resealing and purging operations…LEV (local exhaust ventilation) is not controlling a health hazard, but only serves to lower vapour and aerosol levels below the LEL (lower explosive limits)[77]’

3.104. Further material appears to approve this standpoint. For example, a SIMTARS Report suggests ventilation as a means of removing airborne MEK from the atmosphere and decreasing LEL (lower explosive limit)[78]. A minute from GPCAPT Sargeant to the DSMA states that, ‘...indications are that non compliance with ventilation requirements have resulted in the explosive level regularly exceeding 5%’[79]. A September 2000 SCA-Fuel Tank Investigation recommends increased levels of ventilation in order to dilute and remove the explosive contaminants, and therefore reduce the potential explosive hazards[80]. In McMenamin’s 1997 health hazard summary, ventilation is suggested as a solution to explosive hazards when solvent concentrations rise over 20% of LEL[81]. Finally, in an interview with WCDR Secker, CPL Anderson stated that ventilated air was ‘pumped’ to prevent MSA LEL metres from ‘going off’[82].

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74 IOI.0013.368, Industrial Hygiene Evaluation of F111 Fuel Tank Sealant Process dated 1 Dec 92; AMB.0004.048, Industrial Hygiene Evaluation of F111 Fuel Tank Sealant Process dated 1 Oct 94.

75 WIT.0189.001, Witness Statement of WH McClymont; WIT.0273.001, Witness Statement of DA Saunders; IOI.0019.041, Transcript of proceedings - CPL Spies dated 26 Aug 00

76 WIT.0015.001, Witness Statement of SP Andrews

77 IOI.0032.214, Annual Industrial Hygiene Survey of The F111 Reseal Unit

78 IOI.0054.009, Minutes of The Final Quality Review Meeting to Finalise Procedural Issues Associated with Fuel Tank Entry on 19 Sep 00

79 AMB.0017.046, Fuel Tank Maintenance - Explosive Hazard Management dated 22 Jun 00

80 AMB.0102.001, Fuel Tank Ventilation GSE dated 20 Sep 00

81 IOI.0032.211, Health Hazard Summary - F111 Reseal Unit Building dated 2 Oct 97

82 IOI.0019.174, Transcript of Proceedings - CPL Anderson dated 15 Aug 00

3.105. There is some evidence of an attitude that ventilation's primary function was to prevent heat exhaustion and oxygen deficiency - with the more 'administrative' controls of entry permits and monitoring, controlling explosive and toxic hazards[83]. Although ventilation may indeed have been used to control heat and oxygen, this does not negate from the fact that it was also perceived as a means of diluting airborne chemicals and decreasing the LEL, as per the above documentation.

3.106. Several sources, including the Armstrong Report, indicate that the optimum system for spray seal ventilation is a 'push/pull'/'supply/extraction' ventilation system[84]. General approval of the system is embodied in the AAP rules which state that:

> '…all fuel tanks being spray sealed shall have a supply extraction ventilation system' (AAP 7214.003-292-5.)'[85]

3.107. The documents seem to indicate that the TEK 300 and Hokansen HR12 units were used to provide 'supply' ventilation to fuel tanks, during Spray Sealing at Amberley[86].

3.108. In e-mail correspondence between Bogdan Hirstea of SELMU and FLGOFF Damien Hare, it is noted that neither of these systems provides a combined supply/exhaust system[87] - the primary function of these systems being to provide supply ventilation[88]. Further, in the e-mail, FLGOFF Hare says that he is in interested in studying the 'Rhine Air System' as an alternative because he believes it has 'the capacity to provide both supply and extraction.' Hare also states that the Universal Fuel Tank Repair Trolley, a supply ventilation system available at Amberley, is not used for several reasons[89]:

> 'We do have a number of Universal Fuel Tank Repair Trolleys here at Amberley but they are rarely used (for a variety of reasons, one being excessive noise levels, and another being that the internal tank for depuddling operations is not large enough for F111 depuddling.)'[90].

The Extraction System

3.109. There is evidence to indicate that extraction units were not used during the spray seal process. Documentation suggests a number of reasons for the omission of extraction units, including the potential hazard that exhaust hoses posed to rapid fuel tank exit, excessive noise, and obstruction to visual capability, and difficulty in connecting the equipment to fuel tanks.

3.110. For example, in an April 2000 minute of a meeting regarding F111 ventilation issues it was stated that current ventilation was by 'forced conditioned air', provided by the Hokansen and TEK300D/E and that:

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83 IOI.0014.097, Risk Assessment For F111 Fuel Tank Entry dated 22 Oct 97
84 IOI.0013.368, Industrial Hygiene Evaluation Of F111 Fuel Tank Sealant Process dated 1 Dec 92; IOI.0054.009, Minutes of the Final Quality Review Meeting to Finalise Procedural Issues Associated with Fuel Tank Entry in Building on 19 Sep 00; IOI.0065.022, RKI Eagle Gas Monitor Information dated 29 May 00; IOI.0028.053, Defence Publication - Ventilation and Purging Of F111 Fuel Tanks dated 18 Sep 00; IOI.0013.368, Industrial Hygiene Evaluation of F111 Fuel Tank Sealant Process dated 1 Dec 92; AMB.0004.048, Industrial Hygiene Evaluation of F111 Fuel Tank Sealant Process dated 1 Oct 94
85 AMB.0041.001, Royal Australian Air Force Australian Air Publication 7214.003.292.5 Spray Sealing of F111 Fuselage Fuel Tanks dated 21 Jul 97
86 IOI.0002.363, F111 Fuselage Fuel Tank Spray Sealing Inquiry - 1SQN Response To Enquiry Questions dated 1 Jan 00; IOI.0065.022, RKI Eagle Gas Monitor Information dated 29 May 00; AMB.0015.152, Minutes of the Meeting of the Investigation Team and F111 Support Units, on Ventilation Issues, Held In Building 248 Investigation Office on 03 Apr 00; IOI.0019.065, Minutes of the Meeting of the Investigation Team and F111 Support Units, on Ventilation Issues, Held In Building 248 Investigation Office on 03 Apr 00
87 IOI.0065.022, RKI Eagle Gas Monitor Information dated 29 May 00 at page 2 para 5.
88 AMB.0102.084, Defence Publication -Ventilation and Purging Of F111 Fuel Tanks dated 1 Jan 99
89 AMB.0102.084, Defence Publication -Ventilation and Purging Of F111 Fuel Tanks dated 1 Jan 99
90 IOI.0065.022, RKI Eagle Gas Monitor Information dated 29 May 00 at page 2 para 4.

> ‘ If an extraction unit was to be used in addition, a further hose is to be introduced to the access hole in the tank. This could cause safety problems on the event of a need for rapid exit of the tank’[91].

3.111. The view that extraction hoses posed a potential hazard, is supported by a SIMTARS report dated as at September 19, 2000 which states that the only equipment capable of providing extraction:

> ‘…requires hoses to be placed at the entrance of the tank…[which is] potentially dangerous because entrance to the tank is hindered’[92].

3.112. Different sources, however, cite different reasoning for not using extraction units. During the investigating officer interview of SGT Mills, Mills is reported to have stated:

> ‘…a lot of stuff we’ve never had. Some we have had like the venturis…but too noisy , use too much air and didn’t help them at all….the silly thing was that they [the venturis] were never connected to anything so the fumes were just coming out into the hangar…the guys themselves found out by experience it was best just to leave it off. The gear in the tank cleared a lot quicker and settled and they could see better and everything else. The way its actually written in the AAP is pretty hard to follow exactly how its supposed to have been done’[93]

3.113. And an April 2000 minute of a ventilation meeting states that:

> ‘The use of the venturis…is not carried out in the RAAF for a variety of reasons. These include the fact that attaching the venturis to the aircraft was difficult, the units were noisy, they were ineffectual, and any air moved from inside the tank was deposited immediately outside, where it could be drawn back into the tank, or provide a hazard in its own right’[94].

The Monitoring of LEL

3.114. LEL (lower explosive limit) is defined in AAP 7214.003-292-3 as ‘The concentration of flammable gas or vapour in air above which an explosive gas atmosphere will be formed’[95]. Excessive LEL levels present a potential hazard to spray seal workers. Along with PPE and LEL monitoring, ventilation is cited as a solution to prevent excessive LEL levels[96]. AAP 7214.003-292-3 paragraph 122 states that a ‘responsible person is to check that the atmosphere in the tanks is at safe levels and is respirable’[97].

3.115. The evidence, however, seems to suggest that ventilation and atmospheric monitoring practices were not adequate in preventing excessive LEL levels. For example, a 501 Wing ‘Hot Issues Brief’ dated at the 31 March 2000 states:

> ‘ A significant issue has been identified in relation to the use of cleaning solvents in fuel tanks. There is evidence that explosive levels have consistently exceeded the accepted

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91 AMB.0015.152, Minutes of the Meeting of the Investigation Team and F111 Support Units, on Ventilation Issues, Held in Building 248 Investigation Office on 03 Apr 00

92 IOI.0054.009, Minutes of the Final Quality Review Meeting to Finalise Procedural Issues Associated with Fuel Tank Entry in Building on 19 Sep 00.

93 IOI.0001.262, Transcript of Proceedings - Taped Record of Interview.

94 AMB.0015.152, Minutes of the Meeting of the Investigation Team and F111 Support Units, on Ventilation Issues, Held in Building 248 Investigation Office on 03 Apr 00

AMB.0047.101, Deseal/Reseal of F111C Fuselage Fuel Tanks Health and Environment Quality Control and Equipment Operating Instructions, Ch 1 S103(c) at page 110

IOI.0054.009, Minutes Of The Final Quality Review Meeting To Finalise Procedural Issues Associated With Fuel Tank Entry In Building On 19 Sep 00; AMB.0017.046, Fuel Tank Maintenance - Explosive Hazard Management dated 22 Jun 00; AMB.0018.129, Correspondence dated 8 Feb 00, IOI.0065.014, Report RAAF Mek Spray Test dated 30 Mar 00; IOI.0032.211, Report Health Hazard Summary - F111 Reseal Unit Building 251 2 Oct 97

AMB.0047.101, Defence Publication - Deseal/Reseal Of F111C Fuselage Fuel Tanks Health and Environment Quality Control and Equipment Operating Instructions dated 13-Sep-1990 safe threshold of 5% (of the lower explosive limit). Resolving the ventilation and explosive hazard issues is necessary'[98].

3.116. Further documents, including minutes of meetings and SIMTARS reports respectively, support the fact that ventilation systems were inadequate in preventing excessive LEL:

a. 'Indications are that inadequate explosive level monitoring and ventilation non-compliance have resulted in the explosive level regularly exceeding the 5% threshold'[99]

b. 'During the use of MEK there is a high risk that the concentration will arise above the allowable 5% of LEL…increased ventilation would aid in removing the airborne chemical from the local area, decreasing the LEL…'[100]

c. 'Ventilation trials using existing equipment… concluded that the current ventilation set up was unable to control instantaneous levels of explosive potential…'[101]

3.117. There may have been a number of reasons behind excessive LEL . The first is the fact that staff may have been reluctant to use explosive monitoring equipment. This may have left them unaware of excessive levels of explosive potential - which accordingly may have left them with little opportunity to adjust ventilation levels accordingly. In an interview with WCDR Secker, CPL Anderson states that:

'With ventilated air in there, you pump the ventilated air, then it wouldn't go off….Then we got the new eagles but we also didn't want to contaminate the eagles because they're like $5,000 each…the squadron ruined one an he got a bit in trouble. No one likes to get in trouble, so we didn't want to contaminate the eagles…The spray sealant, the MEK, anything direct upon the eagle would basically clog up the filters and it would be worse' [102].

3.118. LAC Mohapp confirms the above and his statement also seems to indicate that LEL levels were not monitored during spraying:

'But the thing would be getting knocked down and they'd fall into the fuel and they'd be buggered. It was a five grand loader, we were told don't let things drop into the fuel…so half the time it wasn't even in the tank. It would be in the tank to start with, you'd do the LEL and then you'd pull it out…explosive levels not monitored during spraying' [103].

3.119. Other witnesses also indicate that LEL readings were not taken during spraying, for fear of damaging equipment.

'…even with the readings with eagles and the MSA minder, you can't take readings during the spray process. You'll destroy the machine instantly, it just couldn't handle the air particles'[104].

'During the Spray Seal process the LEL metre was not in the fuel tank as it would be covered by sealant, therefore we didn't know the LEL during the process'[105].

98 Corn.0108.140
99 AMB.0017.046, Fuel Tank Maintenance - Explosive Hazard Management 22 Jun 00
100 IOI.0054.009, Minutes of The Final Quality Review Meeting to Finalise Procedural Issues Associated with Fuel Tank Entry in Building on 19 Sep 00.
101 AMB.0102.001, Fuel Tank Ventilation GSE dated 20 Sep 00
102 IOI.0019.174, Transcript of Proceedings -Taped Record of Interview - CPL Anderson dated 15 Aug 00
103 IOI.0019.065, Transcript of Proceedings -Taped Record of Interview - LAC Mohapp dated 9 Aug 00
104 IOI.0019.144, Transcript of Proceedings -Taped Record of Interview - Sgt Mark Orwin (at Q 41) dated 10 Aug 00
105 WIT.0007.001, Witness Statement of CD Allen at para 17.

3.120. Conversely, however, there seems to be evidence that LEL levels were taken at some point of the spray seal process, but is unclear whether this was during spraying or at some other stage of the process[106]. It seems that even when monitoring was reported to have happened, staff took little notice of the excessive LEL level and continued to work on regardless – an example of the operational imperative to 'get the job done'. In an IOI interview, Corporal Spies is quoted as saying:

> 'I said, look guys, you're going to have to stop, we've got fuel downstairs. We've got it everywhere. No she'd be right. I said, no, stop drilling because the LEL's gone up. All right. And they'd get in a huff and puff and carry on. Just the nature of how – I'm trying to explain it here…I think there work practices up here are pretty shocking' [107].

3.121. There is also evidence that LEL measuring equipment might have been inadequate for the purpose of measuring various chemical LELs. In correspondence discussing this issue, with respect to MSDS provided for AVTUR and JET A1, RAAF states that their 'current monitoring equipment, the MSA minder, is only capable of testing explosive atmospheres down to 5%.' The BP MSDSs require testing of LEL down to 1%[108]. The suggestion was that spray seal workers 'make do' with PPE, and continue working, regardless of the fact that air could not be monitored, in accordance with the suppliers MSDS.

3.122. Further, in e-mail correspondence discussing the scope of the board of inquiry, FLGOFF Alan Bowers states that the investigative team are concerned with :

> 'Procedural issues such as incorrect references or data. For example some references state that it is okay to enter a fuel tank up to LEL…20% some say OK to get into up to 5% and get out when it is 10% providing there is continuos monitoring…The actual number is 5% according to the overriding document the DOHSMAN'[109].

3.123. In his affidavit for the IO Corporal David Allen seems to be of the same view:

> 'There seems to be some confusion about the correct LEL level for tank without breathing apparatus. At one time it was 5%, then later it was changed to 1%…' [110]

3.124. It seems that the enforcement of OH&S standards, including prescribed ventilation requirements, took second place to the operational imperative of completing the task. In their affidavits, two witnesses state this exact sentiment:

> 'Basically the engineers set turnaround times that were simply unachievable without compromising health and safety. The emphasis was usually on getting the job done as soon as possible and it was usually a five day window within which to carry out the whole spray seal program'[111].
>
> 'I believe that instructions and orders were not complied with in particular DI (AF) 724.003/292/5. This was not complied with due to aircraft production timings. This affected technical compliance with OH&S. It was impressed upon me that I had to ensure I complied with the time frame that I had been given for the task at hand'[112].

Risk Management

3.125. The main elements of risk management are:

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106 IOI.0019.065, Transcript of Proceedings -Taped Record of Interview - LAC Mohapp dated 9 Aug 00 (Mohapp Q 33); IOI.0019.041, Transcript of Proceedings -Taped Record Of Interview - CPL Spies dated 25 Aug 00 (Spies – Q 43)

107 IOI.0019.041, Transcript of Proceedings -Taped Record Of Interview - CPL Spies dated 25 Aug 00

108 AMB.0018.011, Fuel Tank Entry Below 3% LEL dated16 Apr 98; AMB.0012.099, Confined Space Entry Aircraft Fuel Tanks dated 26 Aug 98

109 IOI.0069.016, Correspondence – "Info For You" dated 26-May-2000

110 WIT.0007.001, Witness Statement of CD Allen

111 WIT.0189.001 Witness Statement McClymont (Q 31)

112 WIT.0015.001, Witness Statement of Andersen at para 28.

a. Hazard identification;

b. Risk assessment;

c. Establishment of risk controls; and

d. Linking risk to management activities.

Relevant SI/BLI

Support Command Australia

SCAI ADMIN 2-4

3.126. SCA Commanders and managers must identify, consider and plan for those risks which may jeopardise the safety and suitability for service of material and not the ability to deliver the ADF's material support requirements.

3.127. It states that Risk management is a key corporate governance activity and Commanders and managers at all levels within SCA are responsible and accountable for ensuring that risk is controlled through formal risk management[113].

3.128. The policy uses the AS/NZS 4360 as its major reference and the content of the policy is in accordance with the intent of the standard. The policy is aimed at addressing the risks associated with strategic, corporate and business planning.

3.129. Annexes to the instruction include, definitions, risk evaluation criteria, SCA risk management flow chart and risk register – SCA common risks and Risk treatment matrix. It clearly outlines responsibilities and processes as well as providing adequate tools for risk management decision-making. No implementation directive is found in the instruction:

> '… the SCA directive on risk management provides a sound workable and robust policy, which provides a level of adequate procedural guidance at this organisational level on risk management'[114].

501 WING SI (LOG) 16-1-1
Management of Hazardous Substances

3.130. The aim of the SI is to ensure that hazardous substances are managed in a healthy and safe manner and IAW Hazardous Substances regulations.

3.131. The Workplace Safety Improvement Team Leader (SITL) is responsible for the following activities:

a. Conducting the 'Inventory of Substances' at Annex A to the SI,

b. In conjunction with the SQN or FLT EMOHSA or 382 Environmental services flight, ensuring a risk assessment of hazardous substances is conducted IAW the requirements of the Hazard Substance Risk assessment, Annex B to the SI,

3.132. Determine risk control measures in conjunction with team members where required.

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[113] SCAI ADMIN 2-4 at para 1-2.
[114] EXP.0009.001, Aerosafe F111 Deseal/Reseal BOI Risk Management Report,at page 51 para 2.

Risk Assessment

3.133. SITL's are to undertake risk assessment for each hazardous substance using the 'Substance Risk Assessment' form located in Annex B of the SI. The assessment is to be completed in consultation with Squadron and Flight EMOHSA's to determine whether there is a health risk from exposure to Hazardous Substances used or produced in the workplace.

3.134. Where it is known that the same Hazardous Substances and work processes are used or produced in more than one workplace, the same risk assessment is to be applied. A fresh risk assessment must be carried out if:

a. adverse health effects are reported,

b. adverse effects are detected through health surveillance,

c. task monitoring shows inadequate control of exposure,

d. the task process is changed, or

e. improved control measures become available.

3.135. The SI makes provision for the fact that specialist consultant assessment and assistance in completing the risk assessment may be necessary and request for such assistance should be forwarded to their OIC and Flight/Squadron EMOHSA.

3.136. Geoff McDonald states in his report, on the subject of risk assessment at 501WG, that:

> 'Examples of its use seen with judgements being made on inadequate information and therefore made on a feeling/valuing function'[115].

3.137. Risk Control

3.138. Flight Commanders must ensure, on the basis of a risk assessment, adequate control measures are implemented to prevent exposure to, or minimise the risk to health and the environment from hazardous substances.

Annex B to 501 wing SI (LOG) 16-1-1- Hazardous Substance Risk Assessment

3.139. This is a proforma/worksheet used to conduct a risk assessment of hazardous substances.

3.140. There is no mention of the training required by the SITL to perform risk assessments on hazardous substances. It is possible for a SITL to be performing risk assessments with no formal training.

3.141. People are not necessarily trained before they are appointed to the EMOHSA/SITL positions. There is difficulty in filling the positions. The training of SITL's is left to the Flight and Sections. SITL courses are only run when there is sufficient numbers to make it economical to do so. This combined with the regular change in SITL's due to the posting cycle, makes it possible for a person to fill a posting and subsequently post out without having completed the appropriate training during their time in the position[116].

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115 The Geoff McDonald Class 1 Damage Control Strategies dated 26 Mar 01 at page 214

116 MAN.0007.001, Witness statement of Hal Waddington at para 63.

3.142. The SI states that a risk assessment should be done when introducing a new hazardous substance into the workplace. If generic risk assessments are used are there specific instructions on how they are used? This is not specified clearly in the SI.

3.143. The risk descriptors used are inadequate. There is no clarification on the difference between 'not significant' and 'significant risk'. The important question of whether the residual risk is an acceptable risk is not defined, allowing individuals to define this based on their own perceptions.

3.144. It is not clear who accepts the risk, the assessor or the Flight/SQN EMOHSA. The assessment form does not make this clear. The procedure when the risk is too high is not stated. The acceptable risk for this procedure is not defined. How often the assessment is to be reviewed is also not specified on the form.

3.145. An extensive search of Casebook revealed no hazardous substance risk assessments using the documentation specified in this SI. This is suggestive of non-compliance with a published procedure or the documents were not supplied to the BOI.

3.146. On 2 June 2000 a Chemical Hazard Alert was issued regarding the use of MEK and Toluene – all users to review processes, conduct risk assessments and use PPE[117]. This alert specifies a risk assessment must be done on all chemicals and recommends the risk assessment tool provided on the DSMA website.

3.147. It appears that after the above hazard alert, chemical assessments were completed using the EMOHS Hazard Identification, Assessment and Control Register Annex A to 501 Wing SI (PERS) 60-3-1[118].

501 WG SI (PERS) 60-3-1
EMOHS Hazard Identification, Assessment & Control Register

3.148. The aim of the instruction is to detail a systematic approach to the identification, assessment, control and reporting of hazards as follows:

a. document and provide a standardised means throughout 501 Wing to identify and evaluate activities, processes and services that may affect the environment and workplace health and safety;

b. enable teams to identify significant hazards to personnel and the environment;

c. provide guidelines in developing effective hazard controls; and

d. empower teams to develop and periodically review procedures.

Responsibilities

3.149. The responsibility for the identification and control of hazards associated with the workplace processes rest with all personnel. Wing/Squadron/Flight Commanders are responsible for managing OH&S issues, however Section heads/Team Leaders have their own EMOHS Duty of Care and will support Commanders to ensure that EMOHS Hazard registers are developed in their teams. Each team will develop and compile an EMOHS

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117 AMB.0048.180, SAFETY SAFETY SAFETY - CHEMICAL HAZARD ALERT dated 2Jun 00
118 AMB.0063.089, EMOHS Hazard Identification Assessment And Control Register 501wg Wings Section Location Bld No 70 dated 1Jun 00

Hazard register. Teams are to set objectives and targets to eliminate or reduce uncontrolled hazards. Maintaining the Hazard register is the responsibility of the SITL. The instruction does not specify who is responsible and accountable for maintaining/reviewing and coordinating all 501 Wing hazard registers.

EMOHS Hazard Register

3.150. Teams are to record and maintain the results of hazard evaluation in the EMOHS Hazard register. Teams shall update the register when processes and legislation changes, and annually review the Register to ensure controls remain current and effective.

3.151. Teams shall determine, for each hazard considered, whether their organisation exerts control or influence over each activity subject to review. Management boundaries shall be identified and teams shall consider hazards under direct control of their organisation and indirect hazards caused by external organisations.

3.152. Annex A and B to the instruction constitute the EMOHS Hazard Identification, Assessment and Control Register. Annex A is the worksheet, whilst Annex B supplies the matrices needed to complete Annex A. The instruction supplies detailed instructions on how to complete Annex A.

ANNEX A TO 501 WG (PERS) 60-3-1 - EMOHS Hazard Identification, Assessment & Control Register

3.153. Is a worksheet that contains a matrice to help determine a numerical risk level by giving Likelihood, Exposure and Impact a numerical value with a corresponding word descriptor. The multiplication of the values given to likelihood, exposure and impact give a final value being the Risk Score. There are 5 different levels of risk, high, significant, moderate, low and acceptable, with a documented management response appropriate to each level, for example, high risk = immediate research and management planning required at senior level. What is senior level is not made clear. There is no ‘showstopper risk score’ (a level of risk where work is to be suspended or ceased) detailed. Again, what the acceptable residual risk is once controls have been implemented is not specified.

3.154. It is not known whether Annex A was especially developed for 501 Wing or was adapted from another document or whether it had been trialed and tested to confirm that the final result – that the risk score is appropriate/realistic. It is not clear whether the completed forms have been validated/reviewed.

3.155. Examples of completed assessment are located at AMB.0156.016 to 018, AMB.0122.104 to 106. It appears that all the initial risk assessments (June/July 2000) were encouraged by the BOI activity. This is suggestive of a reactive safety culture, rather than pro-active.

3.156. The process detailed in Annex A is complex and difficult to follow. This statement is supported by minutes of the EMOHS meeting held on the 13 June 2000 which highlighted the difficulties some Squadrons were having concerning the implementation of Annex A, in particular:

3.157. Risk Management likelihood/consequence classification definitions as per AS/NZS 4360:1995. (First mention of the risk management standard in an SI. 1999 is the current 4360 status),

3.158. Development of a training package prior to implementation.

3.159. It is not known whether this training package was developed and delivered to aid in the SI’s implementation.

3.160. Annex D to 501 WG SI (PERS) 60-3-1

Job EMOHS Analysis Guidelines

3.161. Job EMOHS analysis is the systematic examination of a job to identify, assess and control EMOHS hazards present. The information from this analysis shall be incorporated into job procedures and practices to ensure that employees know how to control any hazards encountered while performing the job.

3.162. Job EMOHS analysis is conducted by Team Leaders as a result of the following activities:

a. change in management;

b. engineering changes;

c. cause analysis related to incidents, inspections and audit findings;

d. review of EMOHS legislation;

e. risk assessments;

f. job observation report analysis; and

g. employee suggestions.

3.163. The four basic steps for successful job safety analysis include;

a. Select the job;

b. Break the job down into its components;

c. Identify the hazards; and

d. Recommend Controls.

3.164. A completed Job EMOHS Analysis worksheet is located at AMB.0122.166.

3.165. Although the SI is dated 31 Mar 98 it was not fully implemented into the entire 501 Wing organisation until 25 May 2000[119]. Initial EMOHS Hazard identification, assessment and control registers were completed in July 2000. The EMOHSO current recommendation is for an external expert to investigate further, to uncover any unidentified Hazards.[120] It is not known whether this request has been approved.

EVIDENCIAL REVIEW

Health Monitoring

3.166. 382HF SOP 39 **-** Occupational Health Assessment (OHA) Requirements – Chemical Hazards.

3.167. This SOP identifies a health assessment requirement for personnel who are:

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119 AMB.0048.117, 501WG OHS Running System dated 25 May 00
120 AMB.0118.247, Process Hazard Profiles dated 8 Jul 00

a. subject to a significant health risk from a Schedule 1 hazardous substance (taken from the Worksafe Code of Practice for the Management of Hazardous Substances);or

b. exposed to a hazardous substance to which an identifiable disease may be related.

3.168. The evidence concerning health monitoring indicates that it was almost completely reactive in nature. Only in the event that someone complained of health problems or a health problem became obvious, did action result. Even then, the reaction was to treat the symptoms rather than looking for a cause. A cross section of the evidence is set out hereunder:

> 'So once we said, okay, these are the symptoms that are in the MSDS sheets as well, they were sent to Medical. Medical was showing that there was nothing wrong with them, and one of the checks when we finally got checks done, blood tests, urine tests, things like that, we were being checked to see if we had liver damage. And that was the total of the check. I objected to this because I consider that's reactive, not proactive. They wait to see if you're damaged. If you are damaged, then, we'll take you out of the section. Since leaving the Air Force, I've had medicals with Boeing, and one of the blood tests and urine tests are sent down to Sydney and they test for the content of MEK in your body. We were told by Medical that this was not possible. So our trust in Medical was very, very limited'[121].
>
> I went to Medical about three years ago with another friend of mine, because we'd had an informal discussion in our workplace about how we were all becoming forgetful, and making stupid mistakes. Like, one guy tried to start his car going home with his wallet. And he was sitting there in his car with his wallet trying to start his car for 15 minutes, and then he realised, 'What am I doing?' Another guy was in the shower wondering why the hell is this soap so hard to apply. 'Oh, turn the shower on first,' you know. They were all very funny stories, and we all thought it was pretty funny, you know, until we realised that every single person in the section had a story to tell like that. And that's when I took upon myself, and I brought one of the other members of the section with me, to Environmental Health and Safety Section. And I said, you know, I know a little bit about chemicals, I know there's toluene in most of the chemicals we use; I know toluene is an active component in glue, and it causes brain damage to glue sniffers, and therefore I thought, well, maybe it's having some effect on us. So I asked the Environmental Health and Safety Officer, I said, 'Oh, can you give me some information?' And he said, 'Look, I'm sure it's fine, don't worry.' And I said, 'Well, that's not good enough. I'd like to know some more. Can you do some testing?' He said, 'Testing's expensive and we're not going to do it, so don't worry about it.'
>
> 'Yes?---And that's how it ended. 'And I went to my boss, my Flight Sergeant, and I said, 'This isn't good enough.. My Flight Sergeant wrote a minute to him in which he wrote a pretty weak minute back saying, 'Okay, I'll see what I can do.' And nothing was done. And that was three years ago. My Flight Sergeant and my Sergeants throughout the years have written minute upon minute upon minute to every rank, all over the place, and received no feedback. Just, 'Don't worry about it, it's okay, it doesn't matter. You should be working. What are you writing minutes for? This is a waste of our time.' And they've gotten that again and again and again. The only exception is, in January of this year - January of last year, and that's how all this came about. One minute was written to the OC of 501 Wing. And that's the only exception[122].
>
> Even when personnel complained of ill health it seemed that the symptoms were treated and the cause not addressed. There doesn't seem to have been any encouragement or even support for the personnel, in fact it has been more the case of 'don't rock the boat'.
>
> 'then I never had the opportunity to see any of the reports or any of the conclusions of Medical. I was never informed of cases of anything being wrong, of anything we should be

[121] Transcripts\Mar29.doc - ORWINTranscript of the of BOI Proceedings M.W. Orwin, at page 328 29/3/2001
[122] Transcripts\Mar29.doc - McCLYMONTTranscript of BOI Proceedings of WH McClymont at page 338 29-3-01

> doing or shouldn't be doing. It was just a case of they would go and they would be taught - treated as an every-day person who went to Medical with a headache or a stomach upset, or whatever. It was never a unique thing that they tied to FTRS[123].

3.169. In more recent times, as a result of AS 2865, health assessments had to be conducted prior to personnel undertaking the Confined Space Entry Course. In October 1999, 382 HF SOP (Standard Operating Procedure) 39 was implemented which provided for routine or periodic OHA's for personnel working with hazardous substances. This was provided for under the Worksafe Code of Practice for the Management of Hazardous Substances. According to the 382 HF SOP39, the only routine health assessments RAAF wide were audiometry tests for personnel in Hearing Protection Areas and 6-monthly Occupational Health Assessments (OHA) for Surface Finishers who use polyurethane paint systems.

3.170. A civilian Medical Practitioner at RAAF Amberley, Dr Paul Shumack states that the RAAF conducted 6 monthly health monitoring of all personnel who worked with hazardous chemicals. This health-monitoring program consisted of blood counts, liver function tests, lung function tests and a yearly general medical examination. He further states that 'Canberra managed the program', notifying the Base Medical Flight when a member was due for health monitoring[124]. This statement contradicts the statements of personnel and documents such as 382HF SOP 39 set out above. A minute from the SMO of 382HF 2-November 2000[125] states clearly that there is no Defence or RAAF policy on health assessments other then the general guidelines under DOHSMAN.

3.171. Personnel report – 'there was no such health monitoring between January 1998 and 1999 and it only started since the investigation and this Board of Inquiry'[126].

3.172. GPCAPT Sargeant – 'We don't have automatic call-out. Whilst we can debate whether it is medicals responsibility to summon people up to medical or whether it's the supervisors – there should be an automatic call-out'[127].

3.173. Doctors have said to GPCAPT Sargeant – 'look we don't have the expertise and we don't have the sort of time to be able to do this' [in regard to Health Monitoring call-outs]

3.174. Other than the annual health assessment and the assessments under SOP39, there does not to appear to have been any organised or consistent system of health monitoring in place. What there was seems to have been reactive in nature. As stated by AVM Weller in his brief to the CAF on the IOs investigation, ' I also doubt that a comprehensive proactive health monitoring procedure was in place'. His doubts seem justified in light of the available documentation concerning this matter.

Audits

Support Command Australia Occupational Health And Safety

SCA1 (PERS) 6-1

3.175. Paragraph 14 provides that success in achieving OH&S objectives within SCA is to be measured in 3 ways, one of which is regular (annual as a minimum) self-audits of units (sample assessment sheet is included). Programmed independent audits will be coordinated centrally by SCA staff for all units over a 3-year rolling period.

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123 Transcripts\Mar29.doc - ORWIN2Transcript of BOI Proceedings of M.W. Orwin at page 328 29/3/2001
124 EXP.0002.001, Witness Statement of Paul Henry Shumack
125 AMB.0118.113, Occupational Health Assessments dated 2 Nov 00
126 WIT.0431.001, Witness Statement of Thomas Skeljo. WIT.0431.001
127 Transcripts\Feb28.doc - SARGEANT2Transcript of Proceedings. R J Sargeant. 28 Feb 01, at page 41.

3.176. Paragraph 24 states it that all Units are to complete the SCA Safety Checklist to benchmark the unit's OH&S management systems and practices, and to identify any areas which require improvement. The date for this to be done by was set down as September 1999.

3.177. Unit Safety Audits (minimum of annual basis) by OH&S trained personnel (Occupational Health & Safety Officer, Health & Safety Representative or Unit Safety Coordinator) to identify risks and hazards are to be conducted. Recommendations from self-audits or independent audits are to be implemented and reported to HQ SCA.

3.178. Regular Plant/Equipment inspections are to be undertaken to ensure compliance to safety standards.

Quality Audits

501WG SI (ADMIN) 2-13-6

3.179. The SI makes reference to AS/NZS ISO 9001: 1994 which requires internal quality systems audits.

3.180. External quality audits are to be conducted to ensure compliance to this standard. An Audit report should be produced from both internal and external audit processes. The Quality Coordinator (appointed by management) shall set the audit schedule. The SI does not specify the frequency with which audits should be conducted.

EMOHS Responsibilities

501WG SI (PERS) 60-10-1

3.181. Paragraph 13 states that COs are to ensure that regular assessments of OH&S systems, performances and resources transpire, and that all operating procedures are regularly reviewed and amended to reflect current legislative & policy requirements.

3.182. The WING EMOHSA (Environmental Management Occupational Health & Safety Adviser) is tasked with;

a. Developing a system for which OH&S audits are conducted within the wing;

b. Performing management system audits and assist where required with other auditing/OH&S assessments; and

c. Squadron EMOHSAs and Section OH&S Coordinators are also tasked with the responsibility of facilitating and assisting with audit processes.

EMOHS Management Review

501WG SI (PERS) 60-10-2

3.183. Management Review is the assessment of active performance of the EMOHS system. The EMOHS Committee advises and makes recommendations for improvements. The EMOHS Steering Committee (meets at 6 month intervals or when recommendations are raised by the Management Committee) has authority to implement these recommendations.

3.184. EMOHSAs are charged with:

a. Providing progress details on Audit Schedules and results (both internal and external).

b. Updating Corrective Action Requests (CARs).

EMOHS Audits/Inspections

501WG SI (ADMIN) 2-13-6-1

3.185. Audits are a requirement of ISO 14001, AS/NZS 4804 and OHSMAN 1. EMOHS Internal Audits are intended to fulfil a number of purposes. These include:

a. To determine the effectiveness of the EMOHS system.

b. To determine the conformance of the system to the above standards.

c. To form part of the Management Review process and provide a basis for the concept of continuous improvement.

Corrective Action Requests

501WG SI (ADMIN) 2-13-6-2

3.186. This SI states that Corrective Action Requests (CARs) replace OA79 Hazard Report and are the recording and reporting mechanism in response to identified non-conformance. However, it then goes on to state that CARs are intended to compliment, not replace any mechanisms already in place. The SI is therefore contradictory and confusing.

3.187. A Hazard report seems to fulfil a separate function from that of a CAR. A Hazard report is a document which notifies the details of a hazard. A CAR is a document which actions a remedy or response, usually in the context of a deficiency highlighted by an audit. The CAR form provide in Annex A does not seems to have a place for the details of the hazard to be recorded, it merely has headings in relation to the corrective action to be taken. It would therefore appear that CARs did not, or could not, replace the Hazard Report.

501WG EMOHS Manual

3.188. The manual states that 501WG is 'firmly committed to a systematic program of EMOHS audits'. These audits constitute part of 501WG's Management Review process IAW ISO 14000 series and AS 3911.

3.189. The Manual goes on to state that, only auditors independent of the particular area being audited may perform EMOHS audits. 501WG EMOHSAs and SITLs (Safety Improvement Team Leaders) determine the scheduling and frequency of EMOHS audits.

Discussion

3.190. The OHSMAN Chapter 27 sets down no time frame for audits, stating that Committees are responsible for deciding the frequency of auditing. Senior Management, OH&S Committees, OH&S Officers, or a Health and Safety Representative are the personnel given the authority to commission an audit.

3.191. DI(AF) (PERS) 60-7 states that COs are responsible for ensuring that audits take place at least annually. 501WG Manual states that EMOHSAs and SITLs have the responsibility of setting the audit schedule but does not state a requirement for annual audit.

3.192. There seems to be a degree of disparity running through the chain of instruction as to the responsibility for commissioning, and the rate of audits. OHSMAN, as the highest level instruction might be deemed as lacking in sufficient detail in order that the DI and subsequently SI could follow on from its intent. The relevant DI has made audits compulsory and given the responsibility to the CO, the 501WG Manual appears to delegate that authority to the EMOHSA, and SITLs. It is unclear as to whether the Committees actually had the function or authority to call for an audit. If the intent of the OHSMAN was to make auditing the responsibility of OH&S Committees, it would seem that this did not eventuate.

3.193. It is assumed that WGCDR Ross relies on DI(AF) PERS 60-7 when he reports that Environmental Health was supposed to conduct a survey of each facility annually with a comprehensive review of OH&S issues including identification of hazards, hazards registers, MSDS's, education, emergency procedures, chemical storage and more.[128] WGCDR Ross further states in his report that this task was given a relatively low priority and has been allowed to lapse in many areas[129].

3.194. As outlined in SCAI (PERS) 6-1, Support Command Australia was to coordinate an external audit of each section, on a 3-year rolling schedule. There is no documentation currently held on Casebook to indicate that this occurred.

3.195. It would seem that audits were either conducted infrequently, in a limited manner, or if they were done, they were not properly documented.

Witness Statements

3.196. One witness indicated the audit was limited to looking at procedure books and MSDS's[130]. Another described health and safety management as being 'pretty lax'[131] and 'OH&S weren't really interested', and 'We were left to our own devices by everyone'[132]. WGCDR Ross comments that such audits were 'given a low priority…been allowed to lapse in many areas, in response to pressures for other tasks to be completed'[133].

> Steart (Spray-Seal Program)
> 'I recall our equipment underwent safety audits on a regular basis but I do not recall anyone monitoring or auditing our safety systems[134]'.
>
> Hogbin (Spray-Seal Program)
> 'I do not recall anyone from outside the section monitoring, reviewing or auditing the safety procedures.'[135]
>
> Weatherby (Spray-Seal Program)
> 'I do not recall anyone independently monitoring health and safety standards' [136]
>
> The statement of GP CAPT Sargeant - 'EMOHS Audits may have lapsed at times within AMF (Aircraft Maintenance Flight) largely because of other pressing OH&S issues.'[137]

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128 EXP.0001.001501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report. WGCDR Ross, above note 67, at page 49, relying on statement of FSGT Murphy at page 21.
129 EXP.0001.001 501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report, WGCDR Ross. P 49.
130 IO interview of SGT Mills.
131 IO interview of LAC Grant.
132 IO interview of CPL Saunders.
133 EXP.0001.001 501WG F111 Fuel Tank Spray Sealing Investigation: Interim Occupational Medicine Report, WGCDR Ross, above note 67, at page 49.
134 WIT.0285.001, Witness Statement of SAC Steart
135 WIT.0139.001, Witness Statement of GJ Hogbin
136 WIT.0314.001, Witness Statement of KM Weatherby
137 HRG.0001.001, Witness Statement of R Sargeant

3.197. There is no indication of what these ‘other pressing OH&S issues’ were.

3.198. As set out in SCAI (PERS) 6-1 Support Command Australia were to receive audit results from units as part of an annual reporting process. If audits were not, in fact conducted or were conducted infrequently, then how were the reports made to SCA or were they submitted at all? If they weren’t made, was this picked up by SCA? There is no evidence of any correspondence with SCA on this issue.

Evidence of Audits on the Casebook Database

Rust PPK Audit (1996)

3.199. Between November 1995 and April 1996, an external agency, Rust PPK, undertook a visual inspection of the facilities at RAAF Base Amberley. Audit restrictions were imposed by the RAAF to exclude the evaluation of procedures. Further, testing (of air quality, Lower Explosive Levels etc) was prohibited unless permission was specifically obtained. The Rust PPK Hazard Report itself evidences the restrictive nature of such conditions, through the inclusion of the frequent disclaimers throughout the body of the report as well as the recommendation that another audit be conducted which allowed such measuring of fumes and chemical levels[138]. It is not known whether these restrictions on the scope of the audit were imposed for financial or other reasons.

3.200. There is evidence of a number of audits conducted within 501 WG in 1997. There is however no evidence of any audit for the FTRS (Fuel Tank Repair Section), which conducted the spray sealing. From 1998 to 2000, there are some references to audits having been conducted for certain sections but no audit documentation/ reports can be found. A number of Corrective Action Requests, indicating that at least one Quality Audit was conducted in 1998, were found.

[138] AMB.0109.117, Executive Summary dated 1Mar 96