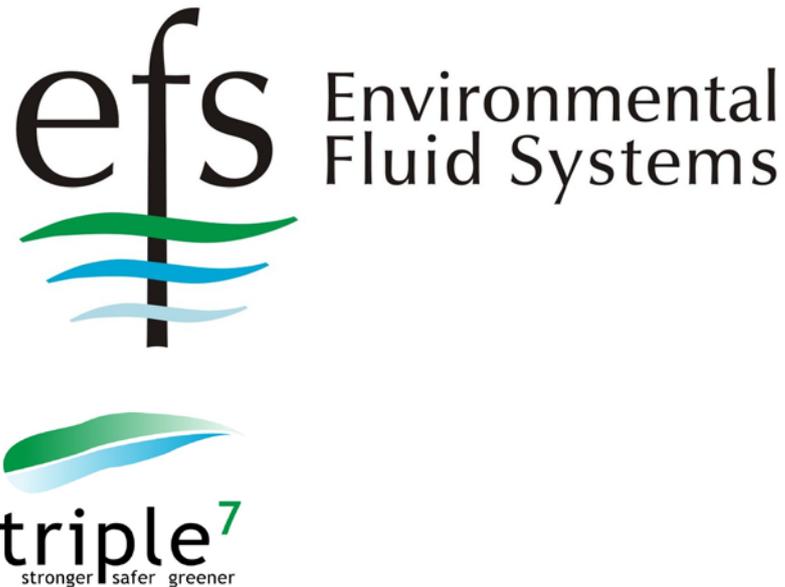


**Company:****Project:**

Aircraft & Metal Cleaner Risk Assessment

**Scope:**

Comparative Assessment for Selected Aircraft & Metal Cleaner Products

**Date of Report:**

10<sup>th</sup> December 2012

**HAZTEK Ref:**

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**Objective:**

To assess and compare the risks of exposure to selected aircraft & metal cleaner products when cleaning aircraft frames and components.

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2. Risk Assessment - Ecolab Air-O-Wash
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4. Risk Assessment - ECO 2000 ZI-400 Colloidal Cleaner

## EXECUTIVE SUMMARY

This report details risk analysis of exposure during aircraft frame and component cleaning and a comparative assessment for selected aircraft & metal cleaner products. Within the context of this assessment the following activities were assessed:

- Aircraft frame and component cleaning with Triple 7 Aircraft & Metal Cleaner;
- Aircraft frame and component cleaning with Ecolab Air-O-Wash;
- Aircraft frame and component cleaning with McGean-Rohco Inc Cee-Bee 280;
- Aircraft frame and component cleaning with ECO 2000 ZI-400 Colloidal Cleaner.

The assessment was conducted following the guidelines outlined in the Australian Institute of Occupational Hygienists, Simplified Occupational Hygiene Risk Management Strategies.

Work Health and Safety Legislation requires that the hierarchy of control be applied when selecting control measures. Substitution, replacing with something less harmful, should be considered in all situations as a risk reduction method.

Aircraft and metal cleaner products are typically used to remove dirt, grease or oil from aircraft frames and components. Products may be used as a concentrate or diluted to the required concentration. The solution is applied via wiping, misting or pressure washers to the surface and allowed to sit on the surface for the required time. The surface is then agitated (if required) prior to rinsing the solutions from the surface.

Exposure can occur during application and agitation of the solution. Exposure can also occur during the decanting process. The assessment considered decanting, application and agitation of the aircraft cleaning product for aircraft frame and component cleaning.

The assessment showed that with the same level of control measures the exposure risk would be significantly lower with Triple 7 Aircraft & Metal Cleaner or the ECO 2000 ZI-400 Colloidal Cleaner compared to the Ecolab Air-O-Wash and the McGean-Rohco Inc Cee-Bee 280 products. A summary of the risk assessment findings by exposure route are detailed in table 15.

**Table 1. Summary of Risk Assessment Findings by Exposure Route**

Control Measures	Risk Assessment Findings by Exposure Route		
	Eye	Dermal	Inhalation
Triple 7 Aircraft & Metal Cleaner	Low	Low	Low
Ecolab Air-O-Wash	Medium	Medium	Medium
McGean-Rohco Inc Cee-Bee 280	Medium	Medium	Medium
ECO 2000 ZI-400 Colloidal Cleaner	Low	Low	Low

Ecolab Air-O-Wash and the McGean-Rohco Inc Cee-Bee 280 products both contain similar concentrations of dipropylene glycol methyl ether. Dipropylene glycol methyl ether is classified as hazardous according to the Safework Australia Criteria as a skin and eye irritant. A skin notation is allocated as the substance can be readily absorbed through the skin. An Exposure Standard-Time Weighted Average (ES-TWA) of 50 ppm 8-hours (HSIS 2011) is prescribed for Dipropylene glycol methyl ether based on the risk of irritation and central nervous system impairment.

Triple 7 Aircraft & Metal Cleaner is a slight skin, eye and throat irritant. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated. Triple 7 Aircraft & Metal Cleaner is classified as non-hazardous according to the Safework Australia Criteria.

ECO 2000 ZI-400 Colloidal Cleaner is a slight skin, eye and throat irritant. Prolonged contact may cause inflammation of the skin. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated. ECO 2000 ZI-400 Colloidal Cleaner is classified as non-hazardous according to the Safework Australia Criteria. The lack of information for the ingredients in ECO 2000 ZI-400 Colloidal Cleaner imposes significant limitation on risk analysis of the products use. For ECO 2000 ZI-400 Colloidal Cleaner risk analysis relied on information provided in the MSDS only.

The assessment found that with the same level of control measures, safe work procedures and PPE, the exposure risk would be significantly lower with Triple 7 Aircraft & Metal Cleaner compared to Dipropylene glycol methyl ether based Aircraft & Metal Cleaner products.

The assessment found the risk with ECO 2000 ZI-400 Colloidal Cleaner to be similar to that Triple 7 Aircraft & Metal Cleaner, however detailed assessment of the ingredients was limited due to lack of the information within the MSDS. Detailed hazard identification and risk assessments are provided within the report.

Work Health and Safety Legislation requires that the hierarchy of control be applied when selecting control measures. Substitution, replacing with something less harmful, should be considered in all situations as a risk reduction method. Reliance on safe work procedures and Personal Protective Equipment (PPE) has been shown to be unreliable.

## 1 INTRODUCTION

This report details risk analysis of exposure during aircraft frame and component cleaning activities and a comparative assessment for selected aircraft & parts cleaner products. Within the context of this assessment the following activities were assessed:

- Aircraft frame and component cleaning with Triple 7 Aircraft & Metal Cleaner;
- Aircraft frame and component cleaning with Ecolab Air-O-Wash;
- Aircraft frame and component cleaning with McGean-Rohco Inc Cee-Bee 280;
- Aircraft frame and component cleaning with ECO 2000 ZI-400 Colloidal Cleaner.

The aims of this risk assessment were to:

1. Identify chemical hazards from selected aircraft & parts cleaner products;
2. Analyse the risk in terms of consequence and likelihood;
3. Provide a comparative assessment of selected aircraft & parts cleaner products;

## 2 METHODOLOGY

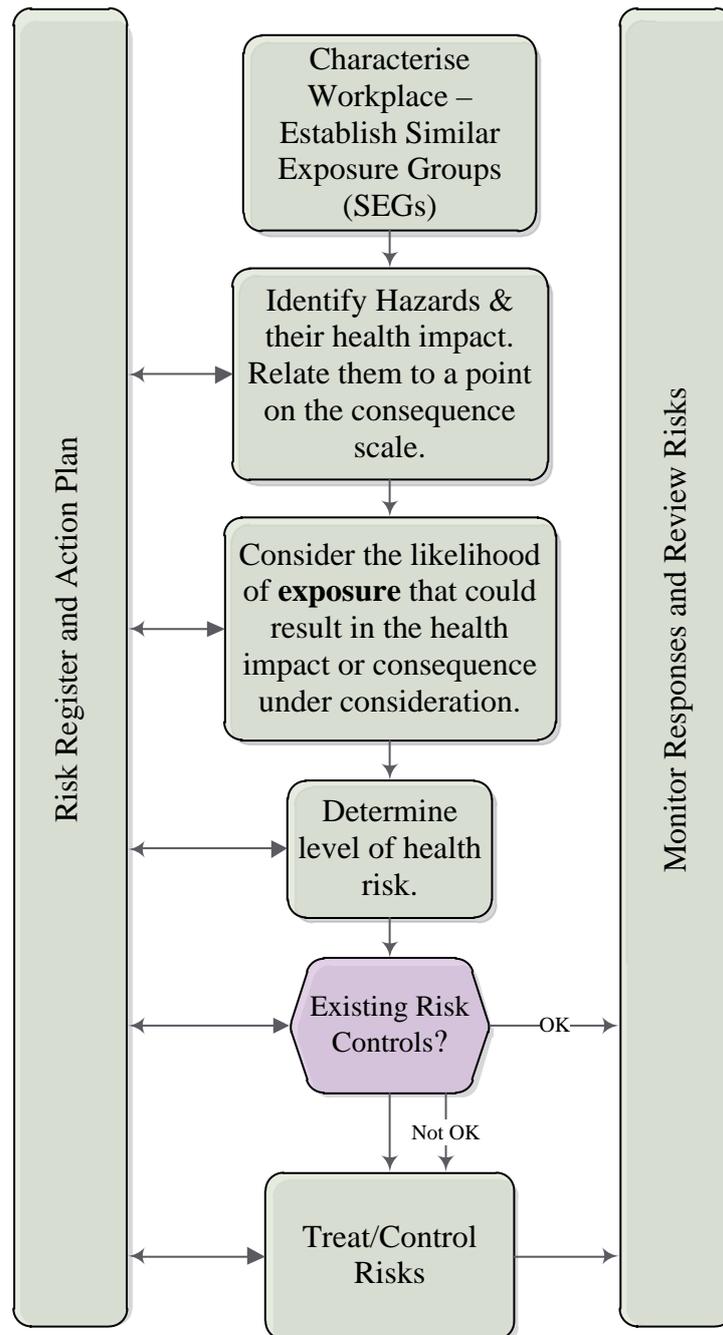
The principles of ISO 31000 were applied using the Australian Institute of Occupational Hygienists, Simplified Occupational Hygiene Risk Management Strategies. The risks were assessed on the principle of what was reasonably foreseeable, refer figure 1 for summary of risk assessment process.

Information from the following sources were used as the primary source of data:

- A review of the assessment reports and toxicological information on selected products;
- A review of typical aircraft parts cleaning work practices and discussions with the representative personnel, including; processes, equipment, materials use, physical environment, products / by-products, etc;
- Typical hours of work and frequency of exposure e.g. Hours of work greater than an 8 hour day, 5 day week (40 hour week) and range of tasks, both routine and occasional.

In undertaking this assessment the author makes the following concessions:

- The review includes assumptions regarding exposure frequency and implemented work practices. These assumptions are based on typical work schedules and recommended safe work procedures for the selected products. This assessment may not be applicable for all work schedules and practices.

**Figure 1: Risk Management Process Schematic**


\* **Note:** Australian Institute of Occupational Hygienists, Simplified Occupational Hygiene Risk Management Strategies Guidelines.

### 3 REFERENCES

(AIOH 2006) Australian Institute of Occupational Hygienists, Simplified Occupational Hygiene Risk Management Strategies Guidelines.

(AS 31000) AS/NZS ISO 31000-2009 Risk Management – Principles and Guidelines.

(EC 2008) European Commission, Joint Research Centre, Institute for Health and Consumer Protection, European chemical Substances Information System, CLP GHS, assessed December 2012 - <http://esis.jrc.ec.europa.eu/>

(HSIS 2011) Safework Australia, Hazardous Substances Information System (Updated – December 2010) accessed January 2012. <http://hsis.ascc.gov.au/>

(IARC 1989a) International Agency for Research on Cancer (IARC), Monograph 45, Kerosene, 1989.

(MSDS 2009) Environmental Fluid Systems, Triple 7 Aircraft & Metal Cleaner, Safety Data Sheet, EFS 2009.

(MSDS 2011a) ECO 2000 ZI-400 Colloidal Cleaner, Safety Data Sheet, 2011

(MSDS 2011) Ecolab, Air-O-Wash, Safety Data Sheet, Ecolab 2011.

(MSDS 2012) Cee-Bee 280, McGean-Rohco Inc, Safety Data Sheet, 2012.

(NICNAS 2011) National Industrial Chemicals Notification and Assessment Scheme (NICNAS), Alcohols, C12-15 ethoxylate, sulfonate, sodium salt (Avanel S-150), 2001

(HERM 2009) Human & Environmental Risk Assessment on ingredients of European household cleaning products Alcohol Ethoxylates, Version 2.0, September 2009.

(OECD 2003) Organisation for Economic Co-operation and Development, SIDS Initial Assessment Report, Screening Information Dataset (SIDS), Propylene Glycol Ethers Category 2003.

(WHS 2011) Work Health and Safety Regulation 2011, Chapter 7, Hazardous Chemicals Qld 2011.

(WHS 2011b) Work Health and Safety Act 2011 (Qld 2011b).

## 4 BACKGROUND

Aircraft and metal cleaners are typically used to remove dirt, grease or oil from aircraft frames and components. Products may be used as a concentrate or diluted to the required concentration. The solution is applied via wiping, misting or pressure washers to the surface and allowed to sit on the surface for the required time. The surface is then agitated prior to rinsing the solutions from the surface.

Exposure can occur during application and agitation of the solution. Exposure can also occur during the decanting process. The assessment considered decanting, application and agitation of the aircraft cleaning product for aircraft frame and component cleaning.

## 5 HAZARDOUS SUBSTANCE RISK ASSESSMENT

Hazardous Substances are regulated through the Work Health and Safety Regulation 2011 Chapter 7 Hazardous Chemicals (WHS 2011a), the regulations are enforceable under the Work Health and Safety Act 2011 (WHS 2011b). The regulations require risk assessments, appropriate to the complexity of the risks, to be conducted for hazardous chemicals. The Australian Institute of Occupational Hygienists developed the Simplified Occupational Hygiene Risk Management Strategies Guidelines to assist industry in meeting their requirements to identify, assess and control risk arising from workplace exposures (AIOH 2006).

### 5.1 HEALTH HAZARDS

When considering the hazards associated with any workplace, it is essential to understand the relationship between 'hazard' and 'risk'. 'Hazard' is the potential for an agent or process to do harm. 'Risk' is the likelihood that an agent will produce injury or disease under specified conditions.

Health effects can occur only if a worker is actually exposed to the hazard. The risk of injury or disease usually increases with the duration and frequency of exposure to the agent, and the intensity/concentration and toxicity of the agent. Toxicity refers to the capacity of an agent to produce disease or injury. The evaluation of toxicity takes into account the route of exposure and the actual concentration of an agent in the body.

### 5.2 EXPOSURE ROUTES

The harmful effects of these chemicals follow inhalation of vapour, eye and skin contact with liquid or vapour, or ingestion, which are described below:

- Inhalation is usually the most significant route of entry by which vapours enter the human body at work.
- Absorption can occur through the skin or cause damage to the skin itself.
- Ingestion is of relatively minor significance in occupational exposure.
- Toxic atmospheric contaminants may have local effects if they harm only the part of the body they come in contact with, or systemic effects causing changes to the function of other organs.

## 6 HEALTH HAZARDS

### 6.1 TRIPLE 7 AIRCRAFT AND METAL CLEANER

The ingredients listed on the MSDS for Triple 7 Aircraft & Metal Cleaner are 1-Methyl Benzotriazole, Additives, Alcohol Ethoxylates, Corrosion Inhibitors and Surfactants. Each ingredient is listed in the MSDS at 1 to 5 % for each with the remainder being non-hazardous ingredients (MSDS 2009).

The MSDS lists the product as non-hazardous according to the Safework Australia Criteria and not a dangerous good (according to the ADG Code).

Triple 7 Aircraft & Metal Cleaner is a slight skin, eye and throat irritant. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated. The main active ingredients of concern in Triple 7 Aircraft & Metal Cleaner are 1-Methyl Benzotriazole and Alcohol Ethoxylates, the toxicology is expanded on below.

#### 1-METHYL BENZOTRIAZOLE

1-Methyl Benzotriazole is a heterocyclic compound containing three nitrogen atoms, with the chemical formula  $C_7H_7N_3$ . At less than 5 % concentration in a solution there is no evidence for 1-Methyl Benzotriazole being genotoxic, mutagenic or carcinogenic. There was no evidence that adverse reproductive or developmental effects have been observed. Evidence indicates that 1-Methyl Benzotriazole is not a contact sensitizer (HSN 2000). No occupational exposure limits / standards were established or recommended in Australia (HSIS) the Netherlands, the UK, and by the ACGIH (USA).

#### ALCOHOL ETHOXYLATES

Alcohol ethoxylates (AE) are a major class of non-ionic surfactants. A substantial amount of toxicological data and information in vivo and in vitro demonstrates that there is no evidence for AEs being genotoxic, mutagenic or carcinogenic. No adverse reproductive or developmental effects are anticipated. AEs are not contact sensitizers. Neat AE are irritating to eyes and skin. The irritation potential of aqueous solutions of AEs depends on concentrations. Local dermal effects due to direct or indirect skin contact in certain use scenarios where the products are diluted are not of concern as AEs are not expected to be irritating to the skin at in-use concentrations. Due to its low toxicity and very low volatility an inhalation risk is not anticipated (NICNAS 2001, HERM 2009).

## 6.2 ECOLAB AIR-O-WASH

The hazardous ingredient listed on the MSDS for Ecolab Air-O-Wash is dipropylene glycol methyl ether. Dipropylene glycol methyl ether is also referred to as (2-Methoxymethylethoxy) propanol. The MSDS lists dipropylene glycol methyl ether at less than 10 % (MSDS 2011).

The MSDS lists the product as hazardous according to the Safework Australia Criteria and not a dangerous good (according to the ADG Code). The MSDS lists the following classification and risk phrases:

- Xi - Irritant
- R36 Irritating to eyes and skin;

Safework Australia has assigned 2-(Methoxymethylethoxy) propanol an Exposure Standard-Time Weighted Average (ES-TWA) of 50 ppm 8-hours (HSIS 2011). The exposure standard is based on the risk of irritation and central nervous system impairment. A skin notation is allocated as the substance can be readily absorbed through the skin.

The most likely route of exposure is eye and skin contact, with some potential for exposure by inhalation of vapour and mists. On inhalation the vapour is irritating or corrosive to the respiratory system and slightly irritating to the respiratory system.

The available data indicates that 2-(Methoxymethylethoxy) propanol is not genotoxic, mutagenic or carcinogenic (OECD 2003).

### 6.3 MCGEAN-ROHCO INC CEE-BEE 280 CLEANER

The hazardous ingredient listed on the MSDS for McGean-Rohco Inc Cee-Bee 280 is dipropylene glycol methyl ether. Dipropylene glycol methyl ether is also referred to as (2-Methoxymethylethoxy) propanol. The MSDS lists dipropylene glycol methyl ether at 3 to 6 % (MSDS 2012).

The MSDS lists the product as hazardous according to the Safework Australia Criteria and not a dangerous good (according to the ADG Code). The MSDS lists the following classification and risk phrases:

- Xi - Irritant
- R36 Irritating to eyes and skin;

Safework Australia has assigned 2-(Methoxymethylethoxy) propanol an ES-TWA of 50 ppm 8-hours (HSIS 2011). The exposure standard is based on the risk of irritation and central nervous system impairment. A skin notation is allocated as the substance can be readily absorbed through the skin.

The most likely route of exposure is eye and skin contact, with some potential for exposure by inhalation of vapour and mists. On inhalation the vapour is irritating or corrosive to the respiratory system and slightly irritating to the skin and eyes.

The available data indicates that 2-(Methoxymethylethoxy) propanol is not genotoxic, mutagenic or carcinogenic (OECD 2003).

#### 6.4 ECO 2000 ZI-400 COLLOIDAL CLEANER

The ingredients listed on the MSDS for ECO 2000 ZI-400 Colloidal Cleaner are anionic surfactants and non-ionic surfactants. Anionic surfactants are listed in the MSDS at 1 to 10 %, non-ionic surfactants are listed in the MSDS at 1 to 10 %, the remainder being non-hazardous additives and water (MSDS 2011a).

The MSDS lists the product as non-hazardous according to the Safework Australia Criteria and not a dangerous good (according to the ADG Code).

The MSDS states that ECO 2000 ZI-400 Colloidal Cleaner may cause eye irritation / damage for some persons and may cause inflammation to the skin. The material may accentuate any pre-existing dermatitis condition. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated.

The main active ingredients of concern in ECO 2000 ZI-400 Colloidal Cleaner are anionic surfactants and non-ionic surfactants. Further information on these ingredients is not provided in the product MSDS or the product information sheets. The lack of information for the ingredients ECO 2000 ZI-400 Colloidal Cleaner imposes significant limitation on risk analysis of the products use.

## 7 RISK ASSESSMENT

The processes involved in conducting risk assessments are to establish the context and hazard of the assessment then analyse these to identify the breakdown event. From this, the risk assessment can be conducted using the formula ‘Risk = Consequence × Likelihood’ to determine the ‘Hazard Risk Ranking’. The Australian Institute of Occupational Hygienists, Simplified Occupational Hygiene Risk Management Strategies Guidelines was used to conduct the assessment. The guidelines are for use in the Australian work environment on how to meet the Australasian Safety and Compensation Council’s requirements for employers to identify, assess and control risks arising from workplace exposures.

Within the context of this assessment the following activities were assessed:

- Aircraft frame and component cleaning with Triple 7 Aircraft & Metal Cleaner;
- Aircraft frame and component cleaning with Ecolab Air-O-Wash;
- Aircraft frame and component cleaning with McGean-Rohco Inc Cee-Bee 280;
- Aircraft frame and component cleaning with ECO 2000 ZI-400 Colloidal Cleaner.

### 7.1 HAZARD IDENTIFICATION

The first step in the risk assessment process is to identify the hazards and relate them to a point on the consequence scale should the event being examined transpire. The Health Hazard Identification form as detailed in Appendix 1 to 4 was used to inventory identified hazards. A summary of the Health Hazard Identification is provided in tables 2 to 5.

**Table 2. Triple 7 Aircraft and Parts Cleaner**

Product	Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Triple 7 Aircraft and Parts Cleaner	1-Methyl Benzotriazole	1 - 5 %.	Not Specified
	Alcohol Ethoxylates	1 - 5 %.	Not Specified
	Corrosion Inhibitors	1 - 5 %.	Not Specified
	Surfactants	1 - 5 %.	Not Specified
	Non-Hazardous Ingredients	Remainder	Not Specified

**Table 3. Ecolab Air-O-Wash**

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Ecolab Air-O-Wash	Dipropylene glycol methyl ether	< 10 %.	Not Specified

**Table 4. McGean-Rohco Inc Cee-Bee 280**

Product	Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
McGean-Rohco Inc Cee-Bee 280	Dipropylene glycol methyl ether	3 - 6 %.	Not Specified

**Table 5. ECO 2000 ZI-400 Colloidal Cleaner**

Product	Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
ECO 2000 ZI-400 Colloidal Cleaner	Anionic surfactants	1 - 10 %.	Not Specified
	Nonionic surfactants	1 - 10 %.	Not Specified
	Additives nonhazardous	1 - 10 %.	Not Specified
	Water	> 60 %	Not Specified

## 7.2 CONSEQUENCE

Having established the context and hazard, the next step in the risk assessment process is to determine the consequence for each hazard. Consequence was assessed as the potential outcome or impact of a hazard. The inherent capacity of a health hazard to cause harm (consequence) was assessed against the tables as detailed in the Consequence Rating for Hazards Annex A. Risk assessments are detailed at Appendix 1 to 4.

## 7.3 EXPOSURE CHARACTERISATION & LIKELIHOOD

Likelihood was determined as a product of the probability and frequency of exposure leading to the particular consequence that is associated with the hazard under consideration. In determining likelihood it is necessary to consider the exposure to a hazard and the probability that harm will occur following that exposure. Exposure was determined in terms of frequency, that is, how often or how long one is exposed, and the concentration, or the level, of the contaminant. Risk assessments are detailed at Appendix 1 to 4.

Annex B Chemical hazards table 1 was used when defining in-air exposure potential qualitatively based on the perceived concentration of exposure.

Annex B Chemical hazards table 4 was used when defining qualitative exposure for dermal exposure potential.

## 7.4 HAZARD / RISK RANKING

To enable risks to be graded against each other (prioritised) a uniform single process for describing the risk level is required. For the determination of risk levels the risk matrix is used, as detailed in the AIOH Simplified Occupational Hygiene Risk Management Strategies was used to determine

relative (not absolute) risk, refer AIOH Simplified Occupational Hygiene Risk Management Strategies Guidelines Annex C table 1 and 2. The outcome of risk assessments will determine the action required; this will be implementation, information gathering, a combination of the two or no action. Generally the need for information gathering will be greater if the information that the risk assessment was based upon has a high degree of uncertainty, for example, if there is limited exposure data. A summary of risk ranking is detailed below.

## 7.5 RISK ASSESSMENT RESULTS

A summary of risk findings is provided at table 6 to 9. Hazard Identification and Risk Assessment are attached as Appendix 1 & 4.

**Table 6. Triple 7 Aircraft & Metal Cleaner**

Route	Consequence	Likelihood	Health Risk
Eye Contact	Minor	Unlikely	Low
Dermal Contact	Minor	Unlikely	Low
Inhalation	Minor	Unlikely	Low

**Table 7. Ecolab Air-O-Wash**

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Unlikely	Medium
Dermal Contact	Moderate	Unlikely	Medium
Inhalation	Moderate	Unlikely	Medium

**Table 8. McGean-Rohco Inc Cee-Bee 280**

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Unlikely	Moderate
Dermal Contact	Moderate	Unlikely	Moderate
Inhalation	Moderate	Unlikely	Moderate

**Table 9. ECO 2000 ZI-400 Colloidal Cleaner**

Route	Consequence	Likelihood	Health Risk
Eye Contact	Minor	Unlikely	Low
Dermal Contact	Minor	Unlikely	Low
Inhalation	Minor	Unlikely	Low

## 7.6 RISK ASSESSMENT FINDINGS

### AIRCRAFT PARTS CLEANING USING TRIPLE 7 AIRCRAFT & METAL CLEANER

The eye contact risk was found to be **low**; the risk was attributed to the potential for periodic incidental contact to a slight eye irritant.

The dermal contact risk was found to be **low**; the risk was attributed to the potential for periodic incidental contact to a slight skin irritant.

The inhalation risk was found to be **low**; the risk was attributed to potential exposure to a low volatility slight respiratory irritant.

### AIRCRAFT AND PARTS CLEANING USING ECOLAB AIR-O-WASH

The eye contact risk was found to be **medium**; the risk was attributed to the potential for periodic incidental contact to a moderate eye irritant and corrosive.

The dermal contact risk was found to be **medium**; the risk was attributed to the potential for periodic incidental contact to a moderate skin irritant and corrosive.

The inhalation risk was found to be **medium**; the risk was attributed to potential exposure to low volatility respiratory irritant and corrosive, which may affect the central nervous system.

### PARTS CLEANING USING MCGEAN-ROHCO INC CEE-BEE 280

The eye contact risk was found to be **medium**; the risk was attributed to the potential for periodic incidental contact to a moderate eye irritant and corrosive.

The dermal contact risk was found to be **medium**; the risk was attributed to the potential for periodic incidental contact to a moderate skin irritant and corrosive.

The inhalation risk was found to be **medium**; the risk was attributed to potential exposure to low volatility respiratory irritant and corrosive, which may affect the central nervous system.

### PARTS CLEANING USING ECO 2000 ZI-400 COLLOIDAL CLEANER

The eye contact risk was found to be **low**; the risk was attributed to the potential for periodic incidental contact to a slight eye irritant.

The dermal contact risk was found to be **low**; the risk was attributed to the potential for periodic incidental contact to a slight skin irritant.

The inhalation risk was found to be **low**; the risk was attributed to potential exposure to a low volatility slight respiratory irritant.

Note: The lack of information for the ingredients ECO 2000 ZI-400 Colloidal Cleaner imposes significant limitation on risk analysis of the products use.

## 8 DISCUSSION

Work Health and Safety Legislation requires that the hierarchy of control be applied when selecting control measures. Substitution, replacing with something less harmful, should be considered in all situations as a risk reduction method.

Aircraft and metal cleaners are typically used to remove dirt, grease or oil from aircraft frames and components. Products may be used as a concentrate or diluted to the required concentration. The solution is applied via wiping, misting or pressure washers to the surface and allowed to sit on the surface for the required time. The surface is then agitated prior to rinsing the solutions from the surface.

Exposure can occur during application and agitation of the solution. Exposure can also occur during the decanting process. The assessment considered decanting, application and agitation of the aircraft cleaning product for aircraft frame and component cleaning.

The assessment showed that with the same level of control measures the exposure risk would be significantly lower with Triple 7 Aircraft & Metal Cleaner or the ECO 2000 ZI-400 Colloidal Cleaner compared to the Ecolab Air-O-Wash and the McGean-Rohco Inc Cee-Bee 280 products. A summary of the risk assessment findings by exposure route are detailed in table 10.

**Table 10. Summary of Risk Assessment Findings by Exposure Route**

Control Measures	Risk Assessment Findings by Exposure Route		
	Eye	Dermal	Inhalation
Triple 7 Aircraft & Metal Cleaner	Low	Low	Low
Ecolab Air-O-Wash	Medium	Medium	Medium
McGean-Rohco Inc Cee-Bee 280	Medium	Medium	Medium
ECO 2000 ZI-400 Colloidal Cleaner	Low	Low	Low

Ecolab Air-O-Wash and the McGean-Rohco Inc Cee-Bee 280 products both contain similar concentrations of dipropylene glycol methyl ether. Dipropylene glycol methyl ether is classified as hazardous according to the Safework Australia Criteria as a skin and eye irritant. A skin notation is allocated as the substance can be readily absorbed through the skin. An ES-TWA of 50 ppm 8-hours (HSIS 2011) is prescribed for Dipropylene glycol methyl ether based on the risk of irritation and central nervous system impairment.

Triple 7 Aircraft & Metal Cleaner is a slight skin, eye and throat irritant. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated. Triple 7 Aircraft & Metal Cleaner is classified as non-hazardous according to the Safework Australia Criteria.

ECO 2000 ZI-400 Colloidal Cleaner is a slight skin, eye and throat irritant. Prolonged contact may cause inflammation of the skin. Due to its low toxicity and moderate volatility a significant inhalation risk is not anticipated. ECO 2000 ZI-400 Colloidal Cleaner is classified as non-

hazardous according to the Safework Australia Criteria. The lack of information for the ingredients in ECO 2000 ZI-400 Colloidal Cleaner imposes significant limitation on risk analysis of the products use. For ECO 2000 ZI-400 Colloidal Cleaner risk analysis relied on information provided in the MSDS only.

## 9 RECOMMENDATIONS / CONCLUSION

Work Health and Safety Legislation requires that the hierarchy of control be applied when selecting control measures. Substitution, replacing with something less harmful, should be considered in all situations as a risk reduction method. Reliance on safe work procedures and Personal Protective Equipment (PPE) has been shown to be unreliable.

The assessment found that with the same level of control measures, safe work procedures and PPE, the exposure risk would be significantly lower with Triple 7 Aircraft & Metal Cleaner compared to Dipropylene glycol methyl ether based Aircraft & Metal Cleaner products.

The assessment found risk with ECO 2000 ZI-400 Colloidal Cleaner to be similar to that Triple 7 Aircraft & Metal Cleaner, however detailed assessment of the ingredients was limited due to lack of the information within the MSDS.

If you have any questions in regards to this analysis or to arrange for a meeting to discuss a Continuous Improvement Action Plan please do not hesitate to contact the under signed.

Regards,

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### **Annex List**

- Annex A: Consequence Rating for Hazards
- Annex B: Chemical Exposure Rating Descriptors
- Annex C: Risk Assessment, Action Identification and Prioritisation

### **Appendix List**

1. Risk Assessment - Triple 7 Aircraft & Metal Cleaner
2. Risk Assessment - Ecolab Air-O-Wash
3. Risk Assessment - McGean-Rohco Inc Cee-Bee 280
4. Risk Assessment - ECO 2000 ZI-400 Colloidal Cleaner

Note: The advice and recommendations contained herein are based on the information supplied during the consultancy. HAZTEK Pty Ltd believes that the advice and information herein are accurate and reliable but no warranty of accuracy or reliability is given and no responsibility arising in any other way whatsoever for errors or omissions (including responsibility to any person by reason of negligence) is accepted by HAZTEK Pty Ltd or officer or employee.

## ANNEX A: CONSEQUENCE RATING FOR HAZARDS

The consequence scale is as follows:

<b>5</b>	<b>Severe</b>	can cause multiple fatalities or significant irreversible effects.
<b>4</b>	<b>Major</b>	can cause a single fatality or irreversible health effects or disabling illness to one or more persons.
<b>3</b>	<b>Moderate</b>	can cause severe reversible health effects of concern – could result in a lost time illness
<b>2</b>	<b>Minor</b>	can cause reversible health effects of concern that would typically result in a medical treatment with no lost time
<b>1</b>	<b>Negligible</b>	can cause reversible health effects of little concern, requiring first aid treatment at most.

Note that a rating of 5 is considered the most serious hazard, while a rating of 1 is least hazardous.

A general description of the health effects for each rating on the consequences scale is provided in the shaded boxes below. Specific agents are listed in Table 2.1 with their respective consequence ratings.

### 5. Severe - can cause multiple fatalities or significant irreversible effects.

Hazards that can cause the following are considered to be potential sources of a “severe” health impact.

- occupational carcinogens
- reproductive toxins
- chemical asphyxiants (e.g. hydrogen sulphide, hydrogen cyanide, carbon monoxide)
- life-threatening respiratory illness agents
- life-threatening zoonoses (i.e. diseases transmitted by animals to humans)
- viral diseases & vector borne diseases that can be fatal

**Occupational Carcinogens** (there are about 300-350 substances). The most common cancers resulting from these exposures are cancers of the lung, bladder, skin, mesothelium, liver, haematopoietic tissue, bone and soft connective tissue. Refer to the list below for some of the more common agents. Check with the International Agency for Research on Cancer (IARC) for others (<http://www-cie.iarc.fr/monoeval/grlist.html>)

**Reproductive Toxins** in the workplace include around 200-300 chemicals. The reported adverse effects include infertility, spontaneous abortion, foetal death, teratogenesis, mutagenesis, foetal cancer, foetotoxicity and retarded development of the foetus or newborn. Both male and female workers may be affected by the hazards.

#### **4. Major - can cause a single fatality or irreversible health effects or disabling illness to one or more persons.**

Hazards that can cause the following are considered to be potential sources of a “major” health impact.

- progressive chronic conditions with a known cause
  - noise induced hearing loss (NIHL)
  - dust induced diseases e.g. silicosis
  - chronic obstructive pulmonary diseases
- systemic poisoning following vapour of fume exposure
- occupational asthma caused by exposure to organic dusts and aerosols
- hematologic disturbance agents ( that cause anaemia, methaemoglobinaemia)
- skin disease – allergic skin diseases are some of the most prevalent occupational diseases. However, physical, chemical or biological agents may cause skin diseases.
- infectious blood borne diseases that can result in progressive chronic disease
- permanent central nervous system damage
- pulmonary oedema
- cardiac arrhythmia
- chronic/long-term organ toxicity e.g. cumulative lung damage
- acute toxicity – high risk – possibly fatal

#### **3. Moderate - can cause severe reversible health effects of concern – could result in a lost time illness.**

Hazards that can cause the following are considered to be potential sources of a “moderate” health impact.

- acute toxicity
- short-term physical effects
  - extreme temperature effects (e.g. sunstroke, frostbite)
- mineral acid effects on teeth
- substances that cause elevated irritation of mucous membranes (eyes, nose or throat)
- substances that cause elevated irritation of the skin
- progressive chronic conditions with a known cause
  - musculo-skeletal effects – disorder of muscles, tendons, bones and joints (e.g. back strain and over-use syndrome). Specific work activities or environments can contribute to musculo-skeletal diseases where particular risk factors are present (e.g. rapid or repetitive motion, forceful exertion, awkward postured, vibration).
  - vibration-induced disorders of muscles, tendons, bones, joints, peripheral blood vessels or peripheral nerves.
  - nervous system effects (e.g. cholinesterase inhibition) other than narcosis
- non-fatal infectious air-borne diseases

**2. Minor - can cause reversible health effects of concern that would typically result in a medical treatment with no lost time**

Hazards that can cause the following are considered to be potential sources of a “minor” health impact.

- some temperature effects (e.g. heat rash)
- some travel effects (e.g. sea sickness, jet lag)
- psychological stress (e.g. work carried out at risk of violence)
- sunburn
- narcosis
- moderate irritation of eyes, nose, throat and / or skin

**1. Negligible - can cause reversible health effects of little concern, requiring first aid treatment at most.**

Hazards that can cause the following are considered to be potential sources of a “minor” health impact.

- minor irritations of eyes, throat, nose and / or skin
- offensive smells
- nuisance noises
- minor muscular discomfort
- minor headaches

**Table 2.1**
**Consequence Rating for Specific Hazards**

**NB** These ratings do not take into account additive effects, nor any other combined effects that exposure to more than one chemical or agent may cause.

Agent	Type Of Hazard	Health Impact	Consequence Scale Rating
Aluminium potroom aerosols	Chemical	Occupational asthma	4
Ammonia	Chemical	Eye damage, upper respiratory tract (URT) irritation	4
Anthrax	Biological	Pulmonary disease often fatal	5
Arsenic	Chemical	Carcinogen	5
Asbestos	Chemical	Carcinogen	5
Avian bird flu	Biological	Severe pulmonary disease with high mortality rate	5
Bacteria	Biological	Allergic response	4
Benzene	Chemical	Carcinogen	5
Beryllium and beryllium compounds	Chemical	Carcinogen	5
Cadmium and compounds	Chemical	Carcinogen	5
Carbon disulphide	Chemical	Peripheral nervous system impairment	4
Carbon monoxide	Chemical	Chemical asphyxiant Carboxyhaemoglobin aemia	5
Ceramic fibres, refractory	Chemical	Carcinogen Pulmonary fibrosis	5
Chromium (VI) and compounds	Chemical	Carcinogen	5
Coal tar pitch volatiles	Chemical	Carcinogen	5
Cold temperatures		Hypothermia chilblains, frostbite	2
Cotton dust	Chemical	Asthma	4
Diesel exhaust particulate	Chemical	Carcinogen	5
Ethylene oxide	Chemical	Carcinogen, Central nervous system impairment	5
Falciparum malaria	Biological	Haematological disease with severe systemic symptoms	5
Fluorine	Chemical	Upper respiratory tract, eye & skin irritation	4
Fungi	Biological	Allergic response	4
Heat (heat cramps, prickly heat, dehydration)	Physical	Hyperthermia	2

**Table 2.1**  
**Consequence Rating for Specific Hazards**

**NB** These ratings do not take into account additive effects, nor any other combined effects that exposure to more than one chemical or agent may cause.

Agent	Type Of Hazard	Health Impact	Consequence Scale Rating
Hepatitis A virus	Biological	Inflammatory condition of the liver	3
Hepatitis B & C virus	Biological	Severe liver disease	4
HIV/AIDS	Biological	Compromised immune system resulting in severe opportunistic infections	5
Hydrogen cyanide	Chemical	Chemical asphyxiant	5
Hydrogen sulphide	Chemical	Chemical asphyxiant	5
Ionising radiation	Physical	Carcinogen	5
Iron	Chemical	URT & skin irritation	2
Isocyanates	Chemical	Occupational asthma	4
Lead	Chemical	Haematological disturbances	4
Legionella bacteria	Biological	Acute lung disease	4
Leptospirosis	Biological	Renal failure	5
Malaria	Biological	Severe infectious	5
Mercury	Chemical	CNS impairment	4
Mould	Biological	Allergic response	4
Musculo-skeletal injury	Physical	Progressive chronic condition	3
Nickel and compounds	Chemical	Pneumoconiosis, Carcinogen	5
Noise induced hearing loss	Physical	Progressive chronic condition	4
Oil mist, mineral	Chemical	LRT irritation, Suspected Carcinogen	5
Organo-phosphorus pesticides	Chemical	CNS dysfunction	3
Ozone	Chemical	Respiratory tract irritation	3
Phosgene	Chemical	URT irritation, emphysema	3
Q-fever	Biological	Acute febrile illness	3
Radon and its decay products	Chemical	Carcinogen	5
Silica, respirable crystalline	Chemical	Carcinogen	5
Solvents	Chemical	CNS depression	3
Sulphuric dioxide	Chemical	URT & LRT irritation	3
Sulphuric acid mist	Chemical	Suspected Carcinogen	5
Talc containing asbestos fibres	Chemical	Carcinogen	5

**Table 2.1**
**Consequence Rating for Specific Hazards**

**NB** These ratings do not take into account additive effects, nor any other combined effects that exposure to more than one chemical or agent may cause.

<b>Agent</b>	<b>Type Of Hazard</b>	<b>Health Impact</b>	<b>Consequence Scale Rating</b>
Temperature – extreme heat or cold	Physical	Sunstroke, frostbite	3
Thallium	Chemical	Alopecia	4
Travel – long distance	Physical	Jet lag	2
Tuberculosis infections	Biological	Chronic granulomatous infection of the lungs	3
Ultraviolet radiation	Physical	Carcinogen	5
Uranium and compounds	Chemical	Carcinogen	5
UV radiation	Physical	Sunburn	2
Vibration-induced disorder	Physical	Progressive chronic condition	3
Wood dust (oak, beech)	Chemical	Carcinogen	5
Wood dust (western red cedar)	Chemical	Asthma	4

**ANNEX B: CHEMICAL EXPOSURE RATING DESCRIPTORS**
**Table 1**
**Qualitative exposure descriptor for In-air Exposure Potential**

A - Almost Certain	Regular contact with the potential hazard at very high concentrations
B – Likely	Periodic contact with the potential hazard at very high concentrations or Regular contact with the potential hazard at high concentrations
C - Possible	Periodic contact with the potential hazard at high concentrations or Regular contact with the potential at moderate concentrations
D – Unlikely	Periodic contact with the potential hazard at moderate concentrations or Regular contact with the potential at low concentrations
E – Rare	Periodic contact with the potential at low concentrations

**Table 2**
**Qualitative exposure descriptor for In-air Exposure Potential**

**Based on an Estimate of the Mean of the Exposure Profile for a work group relative to the OES (possible criteria for frequency of air monitoring is included)**

A - Almost Certain	Mean > 10 x TWA – OES	Reduce exposure and monitor weekly
B – Likely	Mean: > TWA _ OES but < 10 x TWA – OES	Monitor monthly until exposure reduced
C - Possible	Mean: 50% - 100% TWA - OES	Monitor half yearly to quarterly
D – Unlikely	Mean: 10% - 50% TWA - OES	Monitor Yearly
E – Rare	Mean <10% TWA – OES	Monitoring not required (Provided there is no change to the process, material or controls since the last survey.)

**Note:** A TWA-OES (time-weighted-average occupational exposure standard) is the maximum acceptable average concentration of a chemical agent.

**Table 3**
**Qualitative exposure descriptor for In-air Exposure Potential**
**Based on an Estimate of the 95th Percentile for a work group relative to the OES**

A - Almost Certain	>5% exceedance of 10 x OES (95th percentile > 10x OES)
B – Likely	>5% exceedance of the OES (95th percentile between 1 and 10 x OES)
C - Possible	>5% exceedance of 0.5 x OES (95th percentile between 0.5 and 1 x OES)
D – Unlikely	>5% exceedance of 0.1 x OES (95th percentile between 0.1 and 0.5 x OES)
E – Rare	Little to no exceedance of 0.1 x OES (95th percentile <0.1 x OES)

**Table 4**
**Qualitative exposure descriptor for Dermal Exposure Potential**

A - Almost Certain	Regular immersion of hands in contaminant or saturation of clothing
B – Likely	Periodic immersion of hands in contaminant or splashing on clothing or Regular visible contamination of skin or clothing
C - Possible	Periodic visible contamination of skin or clothing; or Regular incidental contact
D – Unlikely	Periodic incidental contact
E – Rare	Minimal to no opportunity for visible contamination of skin or clothing

**Semi- Quantitative exposure descriptor for In-air Exposure Potential**
**Based on the quantities & volatility or “dustiness” of the chemicals handled and the ventilation control<sup>16</sup>**

	Amount	Dustiness/Volatility	Ventilation
A- Almost Certain	Very large amounts (>1000 L or > 1000 kg)	Very dusty (fine light powder) Highly Volatile (boiling point <50°C)	Natural
	Medium to large amounts (>200 L <1000 L or 200 kg <1000 kg)	Very dusty (fine light powder) Highly Volatile (boiling point <50°C).	Natural
B- Likely	Large amounts (>1000 L or >1000 kg)	Dusty (crystalline/granular solids) Moderate volatile (e.g. Boiling point 50°C or <150°C).	Natural
	As per A <sup>#</sup>	As per A <sup>#</sup>	Dilution
C- Possible	Small to medium quantities (>20 l <200 L or >20 kg or <200 kg)	Very dusty (fine light powder) Highly Volatile (boiling point <50°C)	Natural
	Medium to large amounts (>200 L <1000 L or 200 kg <1000 kg)	Dusty (crystalline/granular solids) Moderate volatile (e.g. Boiling point 50°C or <150°C)	Natural
	Large amounts (>1000 L or >1000 kg)	Low dusting (e.g. Pellet-like solids that don't break up) Low volatility (e.g. boiling point >150°C)	Natural
	As per B <sup>#</sup>	As per B <sup>#</sup>	Dilution
	As per A <sup>#</sup>	As per A <sup>#</sup>	Extraction
D- Unlikely	Small quantities (>1 L <20 L or >1 kg <20 kg)	Very dusty (fine light powder) Highly Volatile (boiling point <50°C)	Natural
	Small to medium quantities (>20 l <200 L or >20 kg or <200 kg)	Dusty (crystalline/granular solids) Moderate volatile (e.g. Boiling point 50°C or <150°C)	Natural
	Medium to large amounts (>200 L <1000 L or 200 kg <1000 kg)	Low dusting (e.g. Pellet-like solids that don't break up) Low volatility (e.g. boiling point >150°C)	Natural
	As per C <sup>#</sup> or As per B <sup>#</sup> or	As per C <sup>#</sup> or As per B <sup>#</sup> or	Dilution Extraction
	As per A <sup>#</sup>	As per A <sup>#</sup>	Fully enclosed
E-Rare	Trace quantities (<1 L or <1 kg)	Very dusty (fine light powder) Highly Volatile (boiling point <50°C)	Natural
	Using small quantities (>1 L <20 L or >1 kg <20 kg)	Dusty (crystalline/granular solids) Moderate volatile (e.g. Boiling point 50°C or <150°C)	Natural
	Using small to medium quantities (>20 l <200 L or >20 kg or <200 kg)	Low dusting (e.g. Pellet-like solids that don't break up) Low volatility (e.g. boiling point >150°C)	Natural
	As per B <sup>#</sup> or As per C <sup>#</sup> or	As per B <sup>#</sup> or As per C <sup>#</sup> or	Dilution Extraction
	As per D <sup>#</sup>	As per D <sup>#</sup>	Fully enclosed

# The amount and dustiness/volatility is as per specified in the likelihood scale (A,B,C or D) indicated.

Only the ventilation changes.

## ANNEX C: RISK ASSESSMENT, ACTION IDENTIFICATION AND PRIORITISATION

**Figure 1**

		Consequence Rating (health effect)				
		1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe
Likelihood Rating	A Almost Certain	M	H	H	E	E
	B Likely	M	M	H	H	E
	C Possible	L	M	M	H	H
	D Unlikely	L	L	M	M	H
	E Rare	L	L	L	M	M

Whether the action needed is control, information gathering, or a combination of the two depends on the extent of the potential health risk and the certainty of the exposure assessment, as indicated by the figure below.

**Figure 2**

Health Risk Rating	E	Control Needed	Control & Information Gathering Needed	Control & Information Gathering Needed
	H	Proactive Management Needed	Control & Information Gathering Needed	Control & Information Gathering Needed
	M	Active Monitoring Needed	Information Gathering Needed	Control & Information Gathering Needed
	L	No Action Needed	Information Gathering Needed	Information Gathering Needed
		Certain	Uncertain	Highly Uncertain
<b>Uncertainty Rating</b>				