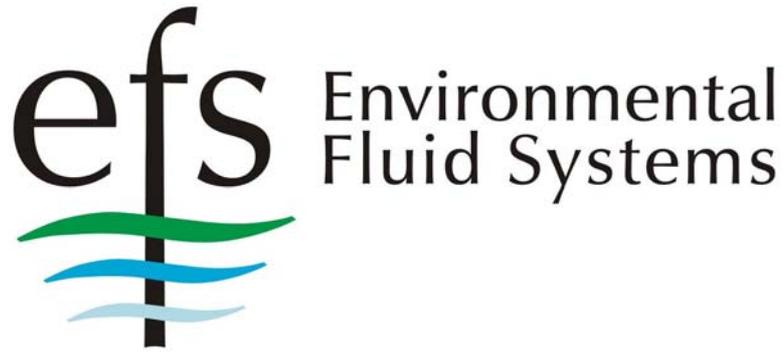


Company:**Project:**

Paint Equipment Cleaner Risk Assessment

Scope:

Cleaning Paint Equipment with Selected Solvents

Date of Review:

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HAZTEK Ref:

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V2.2

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Objective:

To assess and compare the risks of exposure to selected paint equipment cleaner products when cleaning paint equipment.

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EXECUTIVE SUMMARY

This report details risk analysis of exposure during paint equipment cleaning activities and a comparative assessment for selected paint equipment cleaner products. Within the context of this assessment the following activities were assessed:

- Cleaning Paint Equipment with Purasolve Paint Equipment Cleaner;
- Cleaning Paint Equipment with Methyl Ethyl Ketone, Toluene, Xylene or Acetone.

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

Paint spray equipment is cleaned by flushing the system with a solvent. Axillary equipment is cleaned by soaking or scrubbing the equipment with a solvent. Paint Equipment cleaning using acetone or paint thinners should be conducted within a spray booth with respiratory protection. However due to the nature of the process it is often conducted outside of the spray booth without the usual controls such as extraction ventilation and respiratory protection in place. Waste solvent containers are often left open which can also add to the potential for exposure.

The assessment showed that with the same level of control measures, safe work procedures and PPE, the exposure risk would be significantly lower with Purasolve Paint Equipment Cleaner when compared to other commonly used paint equipment cleaning solvents.

Paint thinners are often used to clean paint equipment, they commonly contain mixtures of Methyl Ethyl Ketone (MEK), Toluene or Xylene. Acetone is commonly used to clean paint equipment due to its low cost and a perception that it is a low risk product.

Methyl Ethyl Ketone, Toluene, Xylene and Acetone are skin and eye irritants that can affect the respiratory and nervous system. MEK and Acetone are serious eye irritants (ACGIH 1996, ACGIH 2001). MEK is a possible Teratogenic Toxicant (able to disturb the growth and development of an embryo or foetus agent for humans (ACGIH 2001). Toluene is classified as a reproductive toxicant by the European Commission (EC 2008). Xylene is very hazardous in case of skin contact with the liquid (ACGIH 1992a).

The interaction effects of organic solvents on the nervous system are well known and need to be considered when assessing exposure. Acetone potentiates the neurological toxicity of MEK and other solvents (ACGIH 1996). Combinations of n-hexane with methyl ethyl ketone and also methyl n-butyl ketone with methyl ethyl ketone show increase in peripheral neuropathy, a progressive disorder of nerves of extremities (ACGIH 1992). When selecting appropriate control methods interaction effects need to be understood and allowances made.

The toxicity of these solvents requires that chemical resistant gloves, coveralls and respiratory protection be worn when there is an inhalation and dermal exposure risk. Safe work procedures and adequate supervision are required to ensure control measures are maintained.

Purasolve paint equipment cleaner is a low to moderate irritant. Prolonged or repeated exposure can dissolve the natural protective oils on your skin and can cause dermatitis. D-Limonene, an ingredient at < 25% of Purasolve Paint Equipment Cleaner, readily oxidizes when in contact with air. The oxidized form of d-limonene is a known skin sensitizer. This product or the ingredients are not classified as a carcinogen or reproductive or development toxicants. As with all solvents skin and eye contact should be avoided and the use of eye protection and gloves is recommended. Respiratory protection may be required if spraying product in an enclosed or confined space. Due to the low volatility of Purasolve Paint Equipment Cleaner very high inhalation exposures are not anticipated for typical paint equipment cleaning task.

The assessment showed the exposure risk for when cleaning paint equipment to be significantly lower with Purasolve Paint Equipment Cleaner then with paint thinners containing methyl ethyl ketone, toluene, xylene or acetone. Detailed hazard identification and risk assessment are provided within the report. A summary of risk findings is provided in table 1 to 5.

1. Methyl Ethyl Ketone

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Major	Possible	High

2. Toluene

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Severe	Possible	High

3. Xylene

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Major	Possible	High

4. Acetone

Route	Consequence	Likelihood	Health Risk
Eye Contact	Major	Possible	High
Dermal Contact	Moderate	Possible	Medium
Inhalation	Major	Possible	High

5. Purasolve Paint Equipment Cleaner

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

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 a significant risk reduction would be achieved through the substitution of common paint equipment cleaning solvents with Purasolve Paint Equipment Cleaner. This substitution would also reduce the requirements for detailed safe work procedures, supervision and in most situations respiratory protection.

1 INTRODUCTION

This report details risk analysis of exposure during paint equipment cleaning activities and a comparative assessment for selected paint equipment cleaner products. Within the context of this assessment the following activities were assessed:

- Cleaning Paint Equipment with Purasolve Paint Equipment Cleaner;
- Cleaning Paint Equipment with Methyl Ethyl Ketone, Toluene, Xylene or Acetone.

The aims of this risk assessment were to:

1. Identify chemical hazards from selected paint equipment cleaning products;
2. Analyse the risk in terms of consequence and likelihood;
3. Provide a comparative assessment of selected paint equipment cleaning products;
4. Provide suggested risk treatments for dealing with assessed risks.

2 METHODOLOGY

The principles of AS/NZS 4360 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.

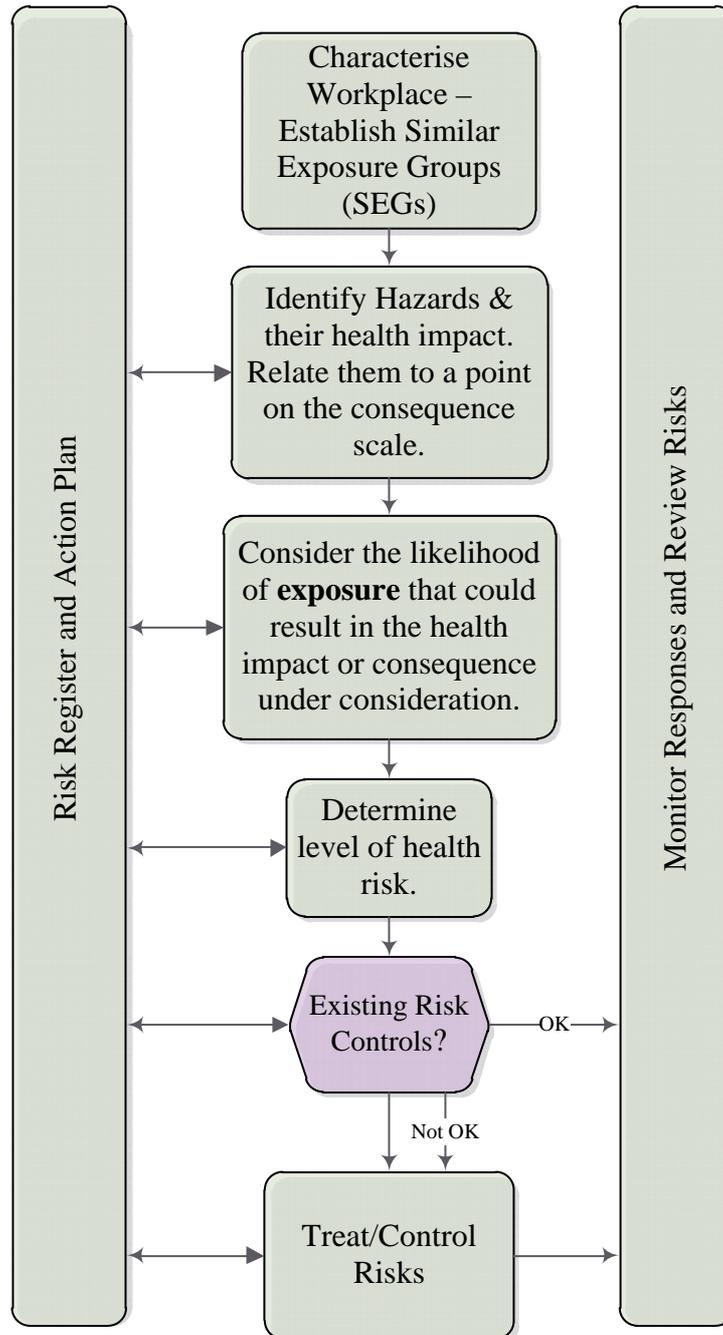
Information from the following sources was used as the primary source of data:

- a review of the assessment reports and toxicological information on selected products;
- a review of paint equipment cleaning work practices and discussions with the representative personnel, including; processes, equipment, materials use, physical environment, products / by-products, etc;
- the 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 (adapted from AS/NZS 4360)*



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

3 REFERENCES

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- (AIOH 2006) Australian Institute of Occupational Hygienist, Simplified Occupational Hygiene Risk Management Strategies Guidelines.
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- (NIH 1990) U.S. Department of Health and Human Services Public Health Service, National Institutes Of Health, National Toxicology Program Technical Report Series No. 3474, Toxicology and Carcinogenesis Studies of D-Limonene (CAS No. 5989-27-5) In F344/N Rats and B6C3F1 Mice (Gavage Studies) 1990.
- (MSDS 2011) Material Safety Data Sheet, Purasolve Paint Equipment Cleaner, EFS 2011.

4 BACKGROUND

4.1 PROCESS

Paint equipment is typically cleaned using solvents such as acetone or paint thinners. Paint spray equipment is cleaned by flushing the system with the solvent. Axillary equipment is cleaned by soaking or scrubbing the equipment with a solvent.

Paint equipment cleaning using acetone or paint thinners should be conducted within a spray booth with respiratory protection. However due to the nature of the process it is often conducted outside of the spray booth without the usual controls such as extraction ventilation and respiratory protection in place. Waste solvent containers are often left open which can also add to the potential for exposure.

5 HAZARDOUS SUBSTANCE RISK ASSESSMENT

Hazardous Substances are regulated through the Queensland Workplace Health and Safety Regulation 2008 Part 16 Hazardous Substances, the regulations are enforceable under the Workplace Health and Safety Act 1995. The regulations require risk assessments, appropriate to the complexity of the risks, to be conducted for hazardous substances. The Australian Institute of Occupational Hygienist 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 fumes 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 PURASOLVE PAINT EQUIPMENT CLEANER HEALTH HAZARDS

The active ingredients listed on the MSDS for Purasolve Paint Equipment Cleaner are Propylene Carbonate and D-Limonene. Propylene Carbonate is listed in the Purasolve Paint Equipment Cleaner MSDS at >75%. D-Limonene is listed at <25%. The MSDS lists risk phrases:

- R36/38 Irritating to eyes and skin;
- R43 May cause sensitisation by skin contact.

The MSDS lists the product as a hazardous substance (Irritant) (according to the Safework Australia Criteria) and not a dangerous good (according to the ADG Code). (MSDS 2011)

PROPYLENE CARBONATE

A substantial amount of toxicological data and information in vivo and in vitro demonstrates that there is no evidence for propylene carbonate being genotoxic, mutagenic or carcinogenic. No adverse reproductive or developmental effects have been observed. Propylene Carbonate is not a contact sensitizer.

Propylene Carbonate is a moderate irritating to the eyes and slightly irritating to the skin. (JACT 1997)

D-LIMONENE

The IARC classifies D-limonene as a Group 3 carcinogen (not classifiable as to its carcinogenicity to humans). D-limonene dissolves the natural protective oils on your skin and can cause dermatitis (dry, rough, red, cracked skin). It readily oxidizes when in contact with air. The oxidized form of d-limonene is a known skin sensitizer. No adverse reproductive or developmental effects have been observed (NTP 1990).

A Workplace Environmental Exposure Level has been established by AIHA (American Industrial of 30 ppm). Due to the low volatility of D-Limonene an inhalation risk is not anticipated under normal conditions of use unless sprayed, heated or large volumes used in confined, poorly ventilated areas. (HSDB 2006)

D-Limonene is irritating to eyes and skin. D-Limonene is sensitising to the skin (NTP 1990)

6.2 METHYL ETHYL KETONE

Methyl Ethyl Ketone (MEK) is commonly referred to as Butanone. MEK is a moderately volatile solvent that is usually used in mixtures with acetone, ethyl acetate, toluene and/or alcohols. Safework Australia have assigned MEK an 8h-TWA limit of 445 mg/m³ (150 ppm) and a 15 minute STEL of 890 mg/m³ (300 ppm) (HSIS).

The European Commission (EC 2008) has assigned the following hazard class and category and hazard codes for use under the Globally Harmonised System:

- Flam. Liq. 2, H225 Highly flammable liquid and vapour.
- Eye Irrit. 2, H319 Causes serious eye irritation.
- STOT SE 3, H336 May cause drowsiness or dizziness.
- EUH006, Repeated exposure may cause skin dryness or cracking.

MEK is a serious eye irritant. MEK that can be absorbed through the skin, repeated exposure can cause contact dermatitis. Inhalation of high concentrations may cause central nervous effects characterized by headache and dizziness. MEK causes respiratory tract irritation and affects the sense organs. Repeated high exposures may affect the liver and urinary system (ACGIH 2001).

The interaction effects of MEK and other organic on the nervous system are well known. Combinations of n-hexane with methyl ethyl ketone and also methyl n-butyl ketone with methyl ethyl ketone show increase in peripheral neuropathy, a progressive disorder of nerves of extremities (ACGIH 1992). Evidence suggests that MEK is not carcinogenic, mutagenic or a development toxicant for humans. MEK is a possible Teratogenic Toxicant (able to disturb the growth and development of an embryo or foetus agent for humans (ACGIH 2001). The EC has not listed a hazard category to MEK as a reproductive toxicant (EC 2008).

6.3 TOLUENE

Toluene is a moderately volatile solvent that is usually used in mixtures with MEK, acetone, ethyl acetate and/or alcohols. Safework Australia have assigned Toluene an 8h-TWA limit of 191 mg/m³ (50 ppm) and a 15 minute STEL of 574 mg/m³ (150 ppm) (HSIS). Absorption through the skin may be a significant source of exposure. ACGIH have reduced their TLV of toluene to Toluene an 8h-TWA limit of 20 ppm to protect workers from neurological effects and the potential for spontaneous abortion in female workers (ACGIH 2006).

The European Commission (EC 2008) has assigned the following hazard class and category and hazard codes for use under the Globally Harmonised System:

- Flam. Liq. 2, H225 Highly flammable liquid and vapour.
- Repr. 2, H361d Suspected of damaging the unborn child.
- Asp. Tox. 1, H304 May be fatal if swallowed and enters airways.
- STOT RE 2, H373 May cause damage to organs through prolonged or repeated exposure
- Skin Irrit. 2, H315 Causes skin irritation.
- STOT SE 3, H336 May cause drowsiness or dizziness.

Toluene is a skin and eye irritant. Toluene can be absorbed through the skin, the vapour is readily absorbed through the lungs. Repeated or prolonged exposure can cause contact dermatitis. Inhalation of high concentrations may cause central nervous effects characterized by headache and dizziness, nausea, loss of consciousness and neurobehavioral and colour vision changes. Toluene causes respiratory tract irritation and affects the sense organs. Repeated high exposures may affect the liver and urinary system (ACGIH 2006).

Evidence suggests that Toluene is not carcinogenic for humans. Toluene is classified as a reproductive toxicant by the European Commission (EC 2008). Toluene caused delayed growth and an increase in skeletal anomaly in the offspring of animals exposed during pregnancy in several studies.

6.4 XYLENE

Xylene is a low to moderately volatile solvent that is commonly used in paint thinners. Xylene encompasses three isomers of dimethylbenzene (ortho-, meta-, and para-). The exposure standard is recommended for all isomers. Safework Australia have assigned Xylene an 8h-TWA limit of 350 mg/m³ (80 ppm) and a 15 minute STEL of 655 mg/m³ (150 ppm) (HSIS).

The European Commission (EC 2008) has assigned the following hazard class and category and hazard codes for use under the Globally Harmonised System:

- Flam. Liq. 2, H225 Highly flammable liquid and vapour.
- Acute Tox. 4, H332 Harmful if inhaled.
- Acute Tox. 4, H312 Harmful in contact with skin.
- Skin Irrit. 2, H315 Causes skin irritation.

Xylene is a skin and eye irritant. Repeated or prolonged exposure can cause contact dermatitis. Xylene is very hazardous in case of skin contact with the liquid. Inhalation of high concentrations may cause central nervous effects characterized by headache and dizziness, nausea, loss of consciousness and some neurobehavioral disorders. Xylene causes respiratory tract irritation and affects the sense organs. Repeated high exposures may affect the blood, kidneys, nervous system and liver (ACGIH 1992a).

Evidence suggests that Xylene is not carcinogenic for humans or a reproductive toxicant.

6.5 ACETONE

Acetone is a moderate to highly volatile solvent that is commonly used for cleaning paint equipment. Acetone is also known as Propanone. Acetone is commonly used in mixtures with methyl ethyl ketone, ethyl acetate, toluene and/or alcohols. Safework Australia have assigned Acetone an 8h-TWA limit of 1185 mg/m³ (500 ppm) and a 15 minute STEL of 2375 mg/m³ (1000 ppm) (HSIS).

The European Commission (EC 2008) has assigned the following hazard class and category and hazard codes for use under the Globally Harmonised System:

- Flam. Liq. 3, H226 Flammable liquid and vapour.
- Eye Irrit. 2, H319 Causes serious eye irritation.
- STOT SE 3, H336 May cause drowsiness or dizziness.
- EUH006, Repeated exposure may cause skin dryness or cracking.

Acetone is a sensory irritant and a serious eye irritant. Repeated or prolonged exposure can cause contact dermatitis. Inhalation of high concentrations may cause central nervous effects characterized by headache and dizziness, nausea, loss of consciousness and some neurobehavioral disorders. Acetone causes respiratory tract irritation and affects the sense organs. Repeated high exposures may affect the kidneys, nervous system and liver (ACGIH 1996).

Evidence suggests that Acetone is not carcinogenic for humans. Some evidence suggests that Acetone may affect reproductive parameters; however the EC has not listed a hazard category to Acetone as a reproductive toxicant (EC 2008).

The interaction effects of Acetone and other organics on the nervous system are well known. Acetone potentiates the neurological toxicity of MEK and other solvents (ACGIH 1996).

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:

- Cleaning Paint Equipment with Purasolve Paint Equipment Cleaner;
- Cleaning Paint Equipment with Methyl Ethyl Ketone;
- Cleaning Paint Equipment with Toluene;
- Cleaning Paint Equipment with Xylene;
- Cleaning Paint Equipment with Acetone.

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 5 was used to inventory identified hazards. A summary of the Health Hazard Identification is provided in tables 1 to 5.

1. Purasolve Paint Equipment Cleaner

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Purasolve Paint Equipment Cleaner	Propylene Carbonate	>75%.	Not Specified
	D-Limonene	<25%.	Not Specified

2. Methyl Ethyl Ketone

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Methyl Ethyl Ketone	Methyl Ethyl Ketone	100%.	8h-TWA 445 mg/m ³ (150 ppm) 15 minute STEL of 890 mg/m ³ (300 ppm) (HSIS).

3. Toluene

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Toluene	Toluene	100%.	8h-TWA 191 mg/m ³ (50 ppm) 15 minute STEL of 574 mg/m ³ (150 ppm) (HSIS). Absorption through the skin may be a significant source of exposure.

4. Xylene

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Xylene	Xylene	100%.	8h-TWA 350 mg/m ³ (80 ppm) 15 minute STEL of 655 mg/m ³ (150 ppm) (HSIS).

5. Acetone

Product	Hazardous Ingredients	Percentage Composition	OES 8 hr TWA/15 min STEL/ other
Acetone	Acetone	100%.	8h-TWA 1185 mg/m ³ (500 ppm) 15 minute STEL of 2375 mg/m ³ (1000 ppm) (HSIS)

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 5.

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 5.

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 10. Hazard Identification and Risk Assessment are attached as appendix 1 & 5.

6. Purasolve Paint Equipment Cleaner

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

7. Methyl Ethyl Ketone

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Major	Possible	High

8. Toluene

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Severe	Possible	High

9. Xylene

Route	Consequence	Likelihood	Health Risk
Eye Contact	Moderate	Possible	High
Dermal Contact	Major	Possible	High
Inhalation	Major	Possible	High

10. Acetone

Route	Consequence	Likelihood	Health Risk
Eye Contact	Major	Possible	High
Dermal Contact	Moderate	Possible	Medium
Inhalation	Major	Possible	High

7.6 RISK ASSESSMENT FINDINGS

PAINT EQUIPMENT CLEANING USING PURASOLVE PAINT EQUIPMENT CLEANER

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

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

The inhalation risk was found to be **low**; the risk was attributed to potential exposure to Propylene Carbonate and D-Limonene, both ingredients are low volatility moderate respiratory irritants.

PAINT EQUIPMENT CLEANING USING METHYL ETHYL KETONE

The eye contact risk was found to be **high**; the risk was attributed to the potential for regular incidental contact to a serious eye irritant.

The dermal contact risk was found to be **high** the risk was attributed to the potential for regular incidental contact to a skin irritant that is toxic through skin absorption.

The inhalation risk was found to be **high**; the risk was attributed to potential exposure to a moderately volatile solvent that may affect the respiratory system and central nervous system.

PAINT EQUIPMENT CLEANING USING TOLUENE

The eye contact risk was found to be **high**; the risk was attributed to the potential for regular incidental contact to irritant.

The dermal contact risk was found to be **high** the risk was attributed to the potential for regular incidental contact to a skin irritant that is toxic through skin absorption and is suspected of damaging the unborn child.

The inhalation risk was found to be **high**; the risk was attributed to potential exposure to a moderately volatile solvent that may affect the respiratory system and central nervous system and is suspected of damaging the unborn child.

PAINT EQUIPMENT CLEANING USING XYLENE

The eye contact risk was found to be **high**; the risk was attributed to the potential for regular incidental contact to an irritant that is very hazardous in case of skin contact with the liquid.

The dermal contact risk was found to be **high** the risk was attributed to the potential for regular incidental contact to a skin irritant that is very hazardous in case of skin contact with the liquid.

The inhalation risk was found to be **high**; the risk was attributed to potential exposure to low to a moderately volatile solvent that may affect the respiratory system, blood, kidneys, nervous system and liver.

PAINT EQUIPMENT CLEANING USING ACETONE

The eye contact risk was found to be **high**; the risk was attributed to the potential for regular incidental contact to a serous eye irritant.

The dermal contact risk was found to be **medium** the risk was attributed to the potential for regular incidental contact to a skin irritant that may cause contact dermatitis.

The inhalation risk was found to be **high**; the risk was attributed to potential exposure to low to a moderately volatile solvent that may affect the respiratory system, kidneys, nervous system and liver.

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.

Paint spray equipment is cleaned by flushing the system with a solvent. Axillary equipment is cleaned by soaking or scrubbing the equipment with a solvent. Paint equipment cleaning using acetone or paint thinners should be conducted within a spray booth with respiratory protection. However due to the nature of the process it is often conducted outside of the spray booth without the usual controls such as extraction ventilation and respiratory protection in place. Waste solvent containers are often left open which can also add to the potential for exposure.

The assessment showed that with the same level of control measures, safe work procedures and PPE, the exposure risk would be significantly lower with Purasolve Paint Equipment Cleaner when compared to other commonly used paint equipment cleaning solvents.

Paint thinners are often used to clean paint equipment, they commonly contain mixtures of Methyl Ethyl Ketone (MEK), Toluene or Xylene. Acetone is commonly used to clean paint equipment due to its low cost and a perception that it is a low risk product.

Methyl Ethyl Ketone, Toluene, Xylene and Acetone are skin and eye irritants that can affect the respiratory and nervous system. MEK and Acetone are serious eye irritants (ACGIH 1996, ACGIH 2001). MEK is a possible Teratogenic Toxicant (able to disturb the growth and development of an embryo or foetus agent for humans (ACGIH 2001). Toluene is classified as a reproductive toxicant by the European Commission (EC 2008). Xylene is very hazardous in case of skin contact with the liquid (ACGIH 1992a).

The interaction effects of organic solvents on the nervous system are well known and need to be considered when assessing exposure. Acetone potentiates the neurological toxicity of MEK and other solvents (ACGIH 1996). Combinations of n-hexane with methyl ethyl ketone and also methyl n-butyl ketone with methyl ethyl ketone show increase in peripheral neuropathy, a progressive disorder of nerves of extremities (ACGIH 1992). When selecting appropriate control methods interaction effects need to be understood and allowances made.

The toxicity of these solvents requires that chemical resistant gloves and coveralls and respiratory protection be worn when there is a risk of inhalation and dermal. Safe work procedures and adequate supervision are required to ensure control measures are maintained.

Purasolve paint equipment cleaner is a low to moderate irritant. Prolonged or repeated exposure can dissolve the natural protective oils on your skin and can cause dermatitis. D-Limonene, an ingredient at < 25% of Purasolve Paint Equipment Cleaner, readily oxidizes when in contact with air. The oxidized form of d-limonene is a known skin sensitizer. This product or the ingredients are not classified as a carcinogen or reproductive or development toxicants. As with all solvents skin and eye contact should be avoided and the use of eye protection and gloves is recommended. Respiratory protection may be required if spraying product in an enclosed or confined space.

9 RECOMMENDATIONS / CONCLUSION

The assessment found that a significant risk reduction would be achieved through the substitution of commonly used paint equipment cleaning solvents with Purasolve Paint Equipment Cleaner. This substitution would also reduce the requirements for detailed safe work procedures, supervision and in most situations respiratory protection.

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 Purasolve Paint Equipment Cleaner
2. Risk Assessment Methyl Ethyl Ketone
3. Risk Assessment Toluene
4. Risk Assessment Xylene
5. Risk Assessment Acetone

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:

- | | | |
|----------|-------------------|---|
| 5 | Severe | can cause multiple fatalities or significant irreversible effects. |
| 4 | Major | can cause a single fatality or irreversible health effects or disabling illness to one or more persons. |
| 3 | Moderate | can cause severe reversible health effects of concern – could result in a lost time illness |
| 2 | Minor | can cause reversible health effects of concern that would typically result in a medical treatment with no lost time |
| 1 | Negligible | 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.

Agent	Type Of Hazard	Health Impact	Consequence Scale Rating
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 control¹⁶

	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
B- Likely	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
	Large amounts (>1000 L or >1000 kg)	Dusty (crystalline/granular solids) Moderate volatile (e.g. Boiling point 50°C or <150°C).	Natural
C- Possible	As per A [#]	As per A [#]	Dilution
	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
D- Unlikely	As per B [#]	As per B [#]	Dilution
	As per A [#]	As per A [#]	Extraction
	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
E-Rare	As per C [#] or As per B [#] or As per A [#]	As per C [#] or As per B [#] or As per A [#]	Dilution Extraction Fully enclosed
	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 [#] or As per C [#] or As per D [#]	As per B [#] or As per C [#] or As per D [#]	Dilution Extraction 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
Uncertainty Rating				