



## **Development of Calibration Factors For Monitoring Theatrical Fog**

Jem ZR33 Hi-Mass with ProSmoke Super (ZR-mix) Fluid  
Jem ZR33 Hi-Mass with ProSteam Simulation Fluid  
Magnum 2500Hz with Pro Haze Fluid  
Jem Glaciator X-Stream with C3 Fluid

Prepared for:  
**Martin Professional A/S.**

Prepared by:  
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Groton, Massachusetts**

Date:  
**August 2008**

Project:  
**08-10829B**

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## 1.0 Introduction

In 1997-99, at the request of Actors' Equity Association (AEA) and the League of American Theaters and Producers (LATP) and with the support of the Equity-League Pension and Health Trust Funds, investigators from the Mount Sinai School of Medicine (Mt. Sinai) and ENVIRON International Corporation (ENVIRON) conducted a study to evaluate whether the use of smoke, fog, haze, and pyrotechnics special effects in theatrical musical productions is associated with a negative health impact in actors. This effort was initiated in response to ongoing concerns by actors that the use of these theatrical effects may have an impact on their health. The results of this study were presented in the report *Health Effects Evaluation of Theatrical Smoke, Haze, and Pyrotechnics* (Mt. Sinai and ENVIRON 2000).

The results of the Mt. Sinai/ENVIRON study indicate that there are certain health effects associated with actors exposed to elevated or peak levels of glycol smoke/fog and mineral oil. However, as long as peak exposures are avoided, actors' health, vocal abilities, and careers should not be harmed. Pyrotechnics as used on Broadway at the time of the study did not have an observable effect on actors' health.

Mt. Sinai and ENVIRON recommended the following peak guidance levels with respect to glycols and mineral oil:

- The use of glycols should be such that an actor's exposure does not exceed **40 milligrams per cubic meter (mg/m<sup>3</sup>)**.
- Mineral oil should be used in a manner such that an actor's exposure does not exceed a peak concentration of **25 mg/m<sup>3</sup>**.
- For chronic exposures to mineral oil, the existing standards established for oil mists (**5 mg/m<sup>3</sup>** as an eight-hour time-weighted average) should also be protective for actors in theatrical productions.

Comparable guidance levels were developed for glycerol in a subsequent study (ENVIRON 2001b):

- Glycerol should be used in a manner such that an actor's exposure does not exceed a peak concentration of **50 mg/m<sup>3</sup>**.
- For chronic exposures to glycerol, the existing standards established for glycerin mists (**10 mg/m<sup>3</sup>** as an eight-hour TWA) should also be protective for actors in theatrical productions.

To ensure that peak smoke, fog, and haze levels are below these guidelines, one option available to productions is to conduct show-specific testing at their theatres using an aerosol monitor. In order to conduct this testing, calibration data must be developed for each equipment/fluid combination. These calibration data are necessary to convert the readings of the aerosol monitor to glycol, mineral oil, or glycerol concentrations. A compilation of calibration

factors that have been approved for use in evaluating compliance with the peak guidance levels is provided on the Theatrical Smoke and Haze Testing page of ENVIRON's web site (<http://www.vironcorp.com/services/article.php?id=61>).

ENVIRON was retained by Martin Professional A/S to develop calibration factors for the following equipment-fluid combinations:

- Jem ZR33 Hi-Mass with Pro Smoke Super Fluid (glycol) **AND** Pro Steam Simulation Fluid (glycol)



- Magnum 2500Hz with Pro Haze Fluid (glycol)



- Jem Glaciator X-Stream with Heavy Fog C3 Fluid



## 2.0 Testing Methodology

### 2.1 Sampling Equipment and Materials

Monitoring of short-term concentrations was performed using portable real-time aerosol monitors (*personal* DataRAM Model PDR-1000) manufactured by Monitoring Instruments for the Environment, Inc. (MIE). The PDR-1000 is a high sensitivity (i.e., photometric) monitor that uses a light scattering sensing chamber to measure the concentration of airborne particulate matter (liquid or solid), providing a direct and continuous readout as well as electronic logging of the data.

The PDR-1000 aerosol monitors as obtained are calibrated to Arizona road dust over a measurement range of 0.001 to 400 mg/m<sup>3</sup>. In order to be utilized to measure short-term glycol or oil mist concentrations, the monitors were first calibrated for the smoke or haze machines and fluids being used. Calibration of the aerosol monitors was conducted by collecting simultaneous measurements with a series of sampling pumps and PDR-1000 aerosol monitors, mounted on tripods.

SKC AirLite sampling pumps were used to draw air through collection media. The fluids tested were glycol-based; therefore, OSHA Versatile Sampler (OVS) traps were used as the collection media, each containing two sections of XAD-7 resin (200-mg front section, 100-mg back section, separated by a polyurethane foam [PUF] plug). The XAD-7 resin was used to collect both the particulate and vapor phase of the glycol aerosol. A 13-mm glass fiber filter (GFF) plug precedes the front section and a PUF plug follows the back section. This sampling is based on a variation of NIOSH Method 5523 (NIOSH 1996; Pendergrass 1999). This calibration sampling was conducted in conjunction with operating the PDR-1000 aerosol monitor.

The calibration sampling was performed at a test facility located at the Groton Dunstable Middle School Theater in Groton, Massachusetts.



## 2.2 Aerosol Monitor Calibration Procedure

A series of tripod assemblies was used for calibrating the aerosol monitors, each consisting of a sampling pump, flexible tubing, sampling media (OVS trap for glycols and cassettes for mineral oil and glycerol), and an aerosol monitor. The height of each tripod was approximately five feet, corresponding with the breathing zone of a typical actor. The room ventilation fans were turned off during each run; no major movement occurred in the testing room during each run that would affect fog dispersion.

- a. The sampling pumps were calibrated to 2 liters per minute (LPM) using a BIOS DryCal pump calibrator. The aerosol monitors were zeroed, the data logging function of the aerosol monitor was turned on, and the data logging times for all of the aerosol monitors were synchronized.
- b. The fog machines were positioned on a bench to allow a release of fog at a height of four to five feet. The tripods were placed at various distances from the smoke machine release nozzle to achieve a range of exposure concentrations.
- c. The sampling pumps were turned on, followed by the fog machines, allowing sustained fog generation to occur. After a period of approximately two and four minutes, the machines and pumps were simultaneously turned off.
- d. The OVS traps were capped and labeled to identify the type of fog machine, glycol fluid, sampling location, and other sampling specifics. After being capped and labeled, the OVS traps were placed in a cooler with ice packs.
- e. Various fans were used between runs to clear residual aerosols from the testing area air by room ventilation.

The collection media and bulk fluid samples, along with appropriate field blanks, were submitted for analysis to Analytics Laboratory of Richmond, Virginia, an American Industrial Hygiene Association (AIHA) accredited laboratory.

## 2.3 Laboratory Analysis

All sample analyses were conducted by using validated analytical methodologies, as described in the ENVIRON Air Sampling Protocol (ENVIRON 2001a).

Samples were analyzed for glycols using a variation of NIOSH Method 5523, which involves the use of a gas chromatograph with a flame ionization detector (GC/FID). The NIOSH Method 5523 was extended to a validated level of quantification (LOQ) of 4.0 to 15.0 micrograms ( $\mu\text{g}$ ) of each individual glycol per sample.

### 3.0 Results and Discussion

#### 3.1 Aerosol Monitor Calibration

Total glycol concentrations were calculated from the analytical data. Only the glycol species measured in the bulk solution were included. For glycol species that were measured in the bulk solution, and were detected in the air sample but not above the LOQ, one half of the LOQ for that glycol species was conservatively used in calculating the total glycol concentration. To develop a calibration curve for each glycol fluid, the average aerosol monitor readings during the period of time in which air was drawn through the OVS trap for each air sample were calculated and plotted against the total glycol concentration data.

The calibration curves for the four equipment-fluid combinations tested are shown in Figures 1 to 4. First order regression curves are also shown on these figures. The calibration factors, calculated from the slopes of these regressions, are summarized in Table 1.

<b>Table 1: Summary of Calibration Factors</b>				
<b>Manufacturer</b>	<b>Machine</b>	<b>Fluid</b>	<b>Fluid Type</b>	<b>Calibration Factor</b>
Martin	Jem ZR33 Hi-Mass	Pro Smoke Super (ZR-mix)	Glycol	0.79
Martin	Jem ZR33 Hi- Mass	Pro Steam Simulation	Glycol	2.31
Martin	Magnum 2500 Hz	Pro Haze	Glycol	0.28
Martin	Jem Glaciator X-Stream	Heavy Fog C3	Glycol	3.23

#### 3.2 Use of Calibration Factors

The real-time aerosol monitor readings can be converted to glycol concentrations using the appropriate calibration factor for the fluid, as follows:

$$CONC = C \times PDR$$

where:

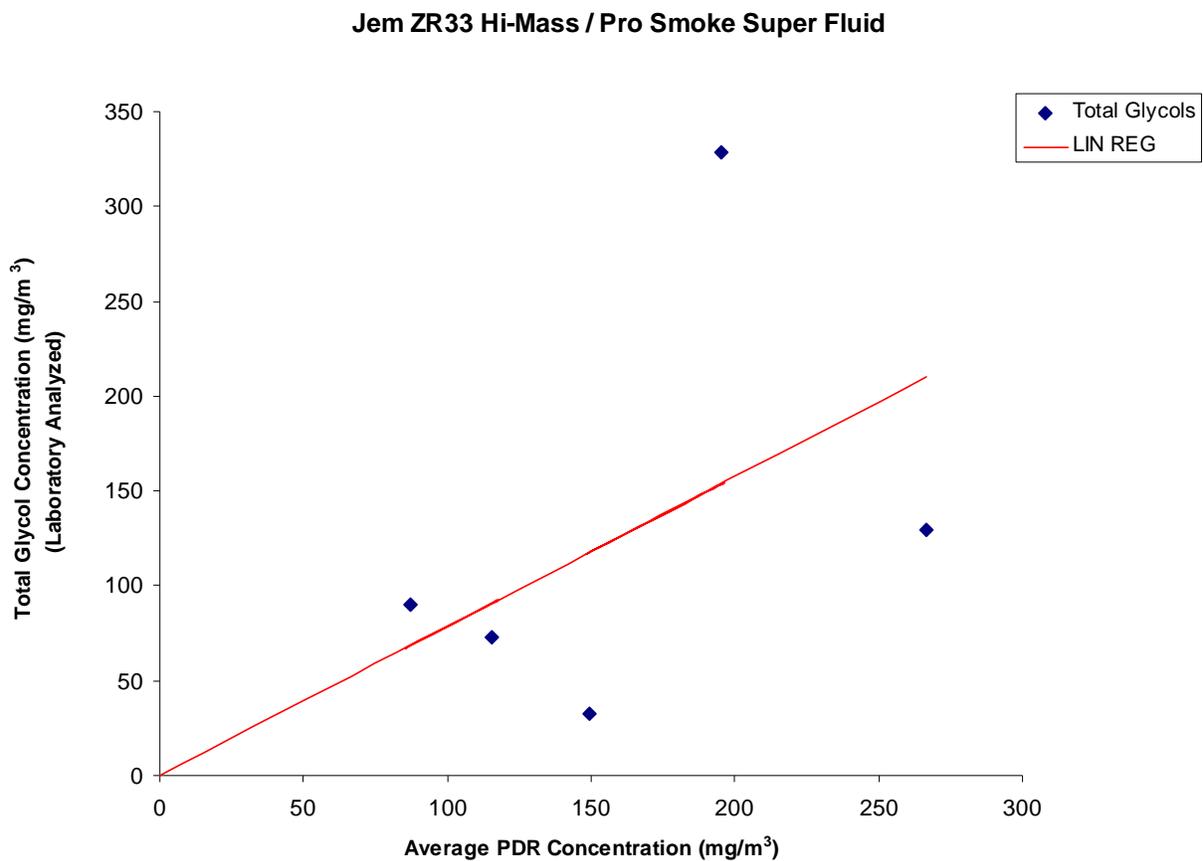
*CONC* = air concentration of total glycols, mg/m<sup>3</sup>

*C* = aerosol monitor calibration factor (mg/m<sup>3</sup>)/ (mg/m<sup>3</sup> aerosol)

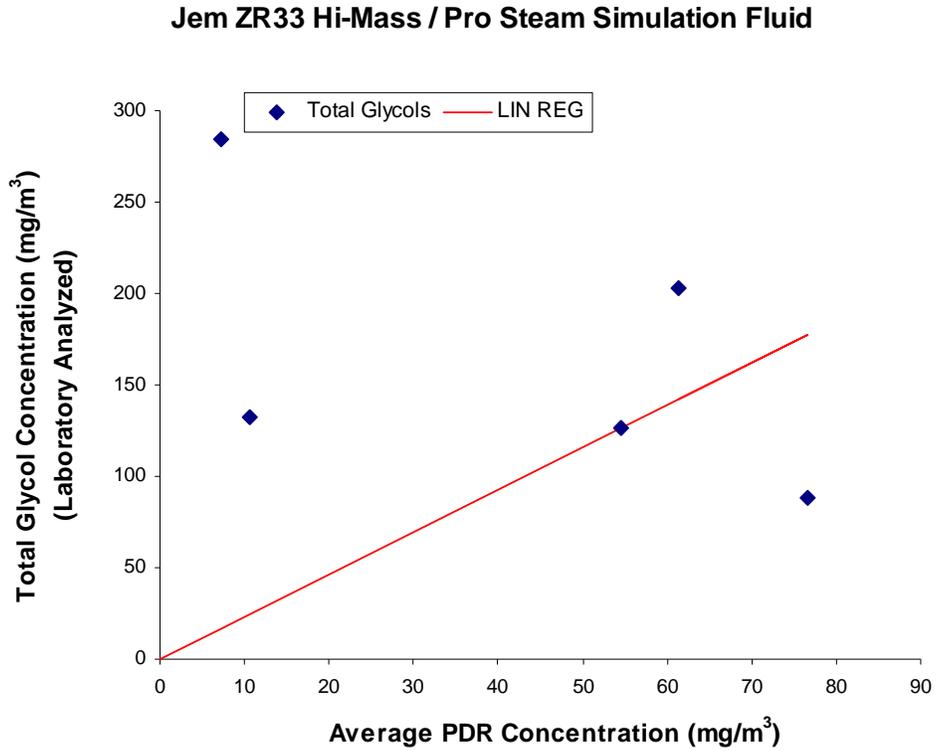
*PDR* = aerosol monitor reading, mg/m<sup>3</sup> aerosol

For example, an uncalibrated reading of 100 mg/m<sup>3</sup> on the aerosol monitor would correspond to a glycol concentration of 28 mg/m<sup>3</sup> for Magnum 2500Hz / ProHaze. These calculated concentrations can then be compared with the peak guidance levels. The peak guidance level for glycols of 40 mg/m<sup>3</sup> would correspond to an uncalibrated aerosol monitor reading of 142 mg/m<sup>3</sup> for the Magnum 2500 Hz / ProHaze combination.

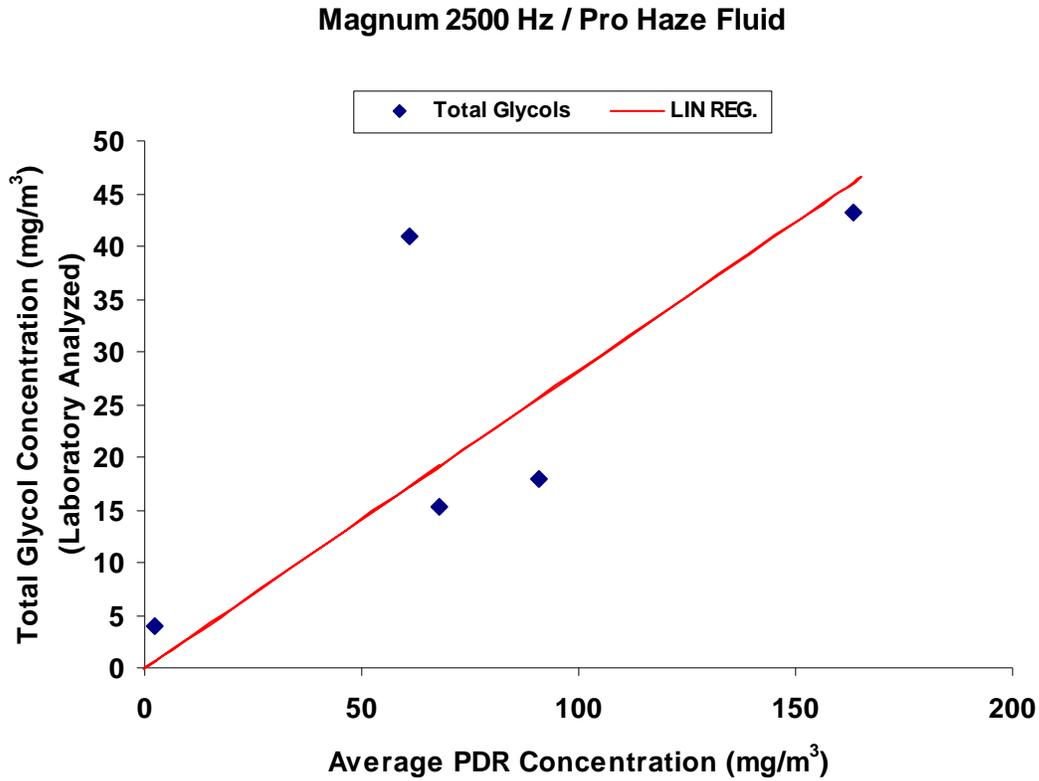
**Figure 1.** Calibration curve for Pro Smoke Super in Jem ZR33 Hi-Mass. Calibration factor, based on slope of curve, is 0.79 (mg/m<sup>3</sup> glycol)/ (mg/m<sup>3</sup> aerosol).



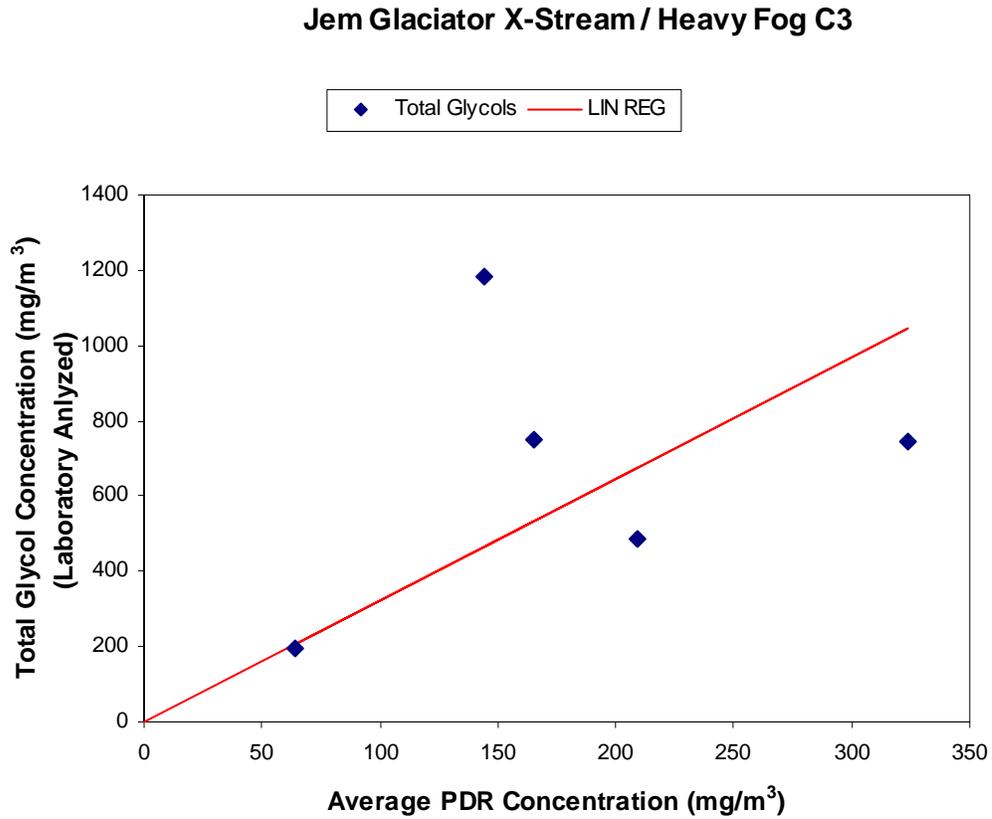
**Figure 2.** Calibration curve for Pro Steam Simulation in Jem ZR33 Hi-Mass. Calibration factor, based on slope of curve, is 2.31 (mg/m<sup>3</sup> glycol)/ (mg/m<sup>3</sup> aerosol).



**Figure 3.** Calibration curve for Pro Haze Fluid in Magnum 2500 Hz. Calibration factor, based on slope of curve, is 0.28 (mg/m<sup>3</sup> glycol)/ (mg/m<sup>3</sup> aerosol).



**Figure 4.** Calibration curve for Heavy Fog C3 in Jem Glaciator X-Stream. Calibration factor, based on slope of curve, is 3.23 (mg/m<sup>3</sup> glycol)/ (mg/m<sup>3</sup> aerosol).



## 4.0 References

- ENVIRON International Corporation (ENVIRON). 2001a. Evaluation of short-term exposures to theatrical smoke and haze: Air sampling protocol. Prepared for Equity-League Pension and Health Trust Funds. May 14.
- ENVIRON International Corporation (ENVIRON). 2001b. Theatrical Haze and Fog Testing for Mamma Mia!, Winter Garden Theatre. Prepared for Mamma Mia! Broadway and Nina Lannan Associates. November 12.
- Mount Sinai School of Medicine and ENVIRON International Corporation (Mt. Sinai and ENVIRON). 2000. Health effects evaluation of theatrical smoke, haze, and pyrotechnics. Prepared for Equity-League Pension and Health Trust Funds. June 6.
- National Institute for Occupational Safety and Health (NIOSH). 1996. Method 5523: Glycols, Issue 1. NIOSH Manual of Analytical Methods (NMAM). Fourth Edition. May 15.
- Pendergrass, S.M. 1999. Determination of glycols in air: Development of sampling and analytical methodology and application to theatrical smokes. *AIHA Journal*, 60:452-457.

## **Appendix A: Material Safety Data Sheets**

ProSmoke Super (ZR-mix) Fluid  
ProSteam Simulation Fluid  
Pro Haze Fluid  
C3 Fluid





# SAFETY DATA SHEET

## PRO SMOKE SUPER FLUID

<b>4. First Aid Measures</b>		
<b>Exposure Route</b>	<b>Symptom</b>	<b>Treatment</b>
Inhalation	Mild irritation of nose & throat	Remove from exposure, rest and keep warm. In severe cases, or if recovery is not rapid or complete, seek medical attention
Skin Contact	Mild irritation	Drench the skin with plenty of water. Remove contaminated clothing and wash before re-use. If large areas of the skin are damaged or if irritation persists seek medical attention
Eye Contact	Mild irritation	Irrigate thoroughly with water for at least 10 minutes. Obtain medical attention
Ingestion	Mild irritation of gastro-intestinal tract	Wash out mouth with water. Do not induce vomiting. If patient is conscious, give water to drink. If patient feels unwell seek medical attention.
<b>5. Fire Fighting Measures</b>		
Suitable Extinguishers		Alcohol-resistant or all-purpose-type foam. Use carbon dioxide or dry powder for small fires only
Unsuitable Extinguishers		Do not direct a solid stream of water or foam into hot burning pools; as this may cause frothing and increase the intensity of a fire
Hazardous Combustion Products		Oxides of carbon including aldehydes
Special Equipment for fire Fighting		Self contained breathing apparatus
<b>6. Accidental Release Measures</b>		
Safety Precautions		Wear appropriate PPE when handling - see section 8
Environmental Precautions		Prevent entry into drains and water courses
Clean up Procedure		Bund or absorb material with sand, earth or other suitable absorbent material. If possible, transfer to a salvage tank, otherwise absorb residues and place in suitable labelled containers and hold for waste disposal - see section 13
<b>7. Handling and Storage</b>		
Safe Handling		Avoid prolonged skin contact. Avoid contact with eyes. Ensure good general ventilation of area. Avoid creating spray. Do not breathe undiluted vapour
Storage		Store in original closed containers Store at ambient temperature Store away from materials listed in section 10
Specific Use(s)		Only for use in designated smoke machine for the production of smoke as a special effect

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:111B              Date:05/01/2005

### 8. Exposure Controls and Personal Protection

Exposure Limit Values	Does not exceed 10mg/m <sup>3</sup> for particulate suspension and 474mg/m <sup>3</sup> for total vapour plus particulates.
Exposure Controls:	
Respiratory	Type approved RPE for organic vapours and mists, if required
Hand	PVC coated or rubber gloves
Eye	Goggles or face shield
Skin	Overalls and boots
Hygiene Measures	Always wash thoroughly after handling chemicals

### 9. Physical and Chemical Properties

Appearance:	Colourless Liquid
Odour:	Mild
pH	Neutral
Boiling Point/Range:	101.6 - 201.6 °C
Melting Point/Range:	< -20 °C
Flash Point:	> 78 °C (test flame extinguished at 78 °C)
Flammability Limits:	2.9 - 18.1 v/v (estimated)
Vapour Pressure:	2.67 kPa at 20°C
Relative density:	1.050 at 20 °C/20 °C
Solubility in water:	Completely miscible

### 10. Stability and Reactivity

Stability	Stable in normal conditions
Known hazardous reactions	Possibility of explosive decomposition if combined with strong acids or bases at elevated temperatures
Conditions to avoid	Elevated temperatures
Materials to avoid	Strong acids and bases; strong oxidisers
Hazardous decomposition products	Oxides of carbon, including aldehydes

### 11. Toxicological Information

OES for monopropylene glycol set at 150 ppm (total vapour and particulates) for 8-hour TWA, and 10 mg/m<sup>3</sup> (particulates) for 15-minute STEL.

LD<sub>50</sub> for monopropylene glycol:

21000 - 33700 mg/kg oral - rat, >10000 mg/kg skin - rabbit.

May cause slight irritation to skin, eyes and mucous membranes. Large doses may produce adverse effects on liver, kidneys and central nervous system.

No evidence in developmental toxicity studies for either embryotoxic or teratogenic effects.



# SAFETY DATA SHEET

## PRO SMOKE SUPER FLUID

### 12. Ecological Information

Mobility	Liquid with low volatility, soluble in water, predicted to have high mobility in soil
Persistence and Degradability	The preparation is largely biodegradable: BOD <sub>5</sub> = 1.08 gO <sub>2</sub> /g; ThOD = 1.68 gO <sub>2</sub> /g; COD = 1.63 gO <sub>2</sub> /g BOD <sub>20</sub> /ThOD = 86%
Bio accumulative Potential	Low
Short and long-term effects	LC <sub>50</sub> , fathead minnow = 4600 - 54900 mg/l EC <sub>50</sub> , Daphnia magna = 4850 - 34400 mg/l
Other	

### 13. Disposal Considerations

Substance	Via an authorised waste disposal contractor to an approved waste disposal site, observing all local and national regulations
Container	As for substance. Used containers must not be cut up or punctured until completely purged of product residues

### 14. Transport Information

No special precautions for transport

### 15. Regulatory Information

Supply label details	In accordance with CHIP 2, Regulation 9.
Label Name	Regular DJ
Symbol	} No risk or safety phrases stipulated
Risk phrases	
Safety phrases	
E.E.C. Number	

Use of this material may be governed by the following regulations:

COSHH, HSWA, MHSW

Users are advised to consult these regulations for further information. The information contained in this data sheet does not constitute an assessment of workplace risk as required by other health and safety legislation.

Revision No.: C      Date:07/06/2007  
Replaces SDS No.:111B      Date:05/01/2005

**SDS No. 111C      Date: June 2007**

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## SAFETY DATA SHEET PRO SMOKE SUPER FLUID

### 16. Other Information

No special training is required for handling this preparation other than normal precautions for safe handling of chemicals

This material is usually used for the production of synthetic smoke in an appropriate JEM smoke- machine. The concentration of smoke components is below the OES under normal operating conditions.

It must not be used for any other purpose, or in any other equipment

Further details may be available on request from the supplier, whose address and telephone number are given in section 1.

**This datasheet updated to meet Commission Directive 2001/58/EC**

#### Sources of information:

Suppliers' Safety Data Sheets for substances used as raw materials in the preparation.

EH 40/97

NFPA 325M

#### Legal Disclaimer:

The above information is based on the present state of our knowledge of the product at the time of publication. It is given in good faith, no warranty is implied with respect to the quality of the specification of the product. The user must satisfy himself that the product is entirely suitable for his purpose.

If you have purchased the product for supply to a third party, it is your duty to take all necessary steps to ensure that any person handling and using the product is provided with the information in this sheet. If you are an employer it is your duty to tell your employees and others who may be affected by any hazard described in this sheet and of any precautions that should be taken.

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:111B              Date:05/01/2005

**SDS No. 111C                      Date: June 2007**

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# SAFETY DATA SHEET

## PRO STEAM SIMULATION FLUID

### 1. Identification of the Substance/Preparation & Company/Undertaking

#### 1. Identification of the substance or preparation:

Name: Pro Steam Simulation Fluid

Synonyms: AA Steam Fluid

#### 2. Use of the substance/preparation:

Fluid for use in the creation of smoke effects using a dedicated smoke machine.

#### 3. Company/undertaking identification:

Martin Manufacturing (UK) Plc.

Tel: +44 (0) 1507 604399

Belvoir Way,

Fax: +44 (0) 1507 601956

Fairfield Industrial Estate,

Louth,

Lincolnshire,

LN11 0LQ

UK

### 2. Composition/Information on Ingredients

Contains:

Food grade glycols

Polyglycols CAS Registry Number: **57-55-6**

De-mineralised water.

Contains no substances in Part 1 of the Approved Supply List, or with a maximum exposure limit (MEL) specified in Schedule 1 of COSHH.

Contains monopropylene glycol, for which an occupational exposure standard has been set

### 3. Hazardous Information:

No significant hazard to man or environment under normal conditions of handling and use.

Ingestion: low toxicity.

Eye/skin: low toxicity

Inhalation: low concentration of hazardous substances in vapour. Undiluted vapour should not be inhaled. (**Note:** The concentration of smoke components in the final product is below the OES under normal operating conditions)

Revision No.: B Date:07/06/2007  
Replaces SDS No.:130A Date:05/09/2006

**SDS No. 122B Date: June 2007**

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# SAFETY DATA SHEET

## PRO STEAM SIMULATION FLUID

<b>4. First Aid Measures</b>		
<b>Exposure Route</b>	<b>Symptom</b>	<b>Treatment</b>
Inhalation	Mild irritation of nose & throat	Remove from exposure, rest and keep warm. In severe cases, or if recovery is not rapid or complete, seek medical attention
Skin Contact	Mild irritation	Drench the skin with plenty of water. Remove contaminated clothing and wash before re-use. If large areas of the skin are damaged or if irritation persists seek medical attention
Eye Contact	Mild irritation	Irrigate thoroughly with water for at least 10 minutes. Obtain medical attention
Ingestion	Mild irritation of gastro-intestinal tract	Wash out mouth with water. Do not induce vomiting. If patient is conscious, give water to drink. If patient feels unwell seek medical attention.
<b>5. Fire Fighting Measures</b>		
Suitable Extinguishers		Alcohol-resistant or all-purpose-type foam. Use carbon dioxide or dry powder for small fires only
Unsuitable Extinguishers		Do not direct a solid stream of water or foam into hot burning pools; as this may cause frothing and increase the intensity of a fire
Hazardous Combustion Products		Oxides of carbon including aldehydes
Special Equipment for fire Fighting		Self contained breathing apparatus
<b>6. Accidental Release Measures</b>		
Safety Precautions		Wear appropriate PPE when handling - see section 8
Environmental Precautions		Prevent entry into drains and water courses
Clean up Procedure		Bund or absorb material with sand, earth or other suitable absorbent material. If possible, transfer to a salvage tank, otherwise absorb residues and place in suitable labelled containers and hold for waste disposal - see section 13
<b>7. Handling and Storage</b>		
Safe Handling		Avoid prolonged skin contact. Avoid contact with eyes. Ensure good general ventilation of area. Avoid creating spray. Do not breathe undiluted vapour
Storage		Store in original closed containers Store at ambient temperature Store away from materials listed in section 10
Specific Use(s)		Only for use in designated smoke machine for the production of smoke as a special effect

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Replaces SDS No.:130A              Date:05/09/2006

**8. Exposure Controls and Personal Protection**

Exposure Limit Values	Does not exceed 10mg/m <sup>3</sup> for particulate suspension and 474mg/m <sup>3</sup> for total vapour plus particulates.
Exposure Controls:	
Respiratory	Type approved RPE for organic vapours and mists, if required
Hand	PVC coated or rubber gloves
Eye	Goggles or face shield
Skin	Overalls and boots
Hygiene Measures	Always wash thoroughly after handling chemicals

**9. Physical and Chemical Properties**

Appearance:	Colourless Liquid
Odour:	Mild
pH	Neutral
Boiling Point/Range:	101.6 - 201.6 °C
Melting Point/Range:	< -20 °C
Flash Point:	> 78 °C (test flame extinguished at 78 °C)
Flammability Limits:	2.9 - 18.1 v/v (estimated)
Vapour Pressure:	2.67 kPa at 20°C
Relative density:	1.050 at 20 °C/20 °C
Solubility in water:	Completely miscible

**10. Stability and Reactivity**

Stability	Stable in normal conditions
Known hazardous reactions	Possibility of explosive decomposition if combined with strong acids or bases at elevated temperatures
Conditions to avoid	Elevated temperatures
Materials to avoid	Strong acids and bases; strong oxidisers
Hazardous decomposition products	Oxides of carbon, including aldehydes

**11. Toxicological Information**

OES for monopropylene glycol set at 150 ppm (total vapour and particulates) for 8-hour TWA, and 10 mg/m<sup>3</sup> (particulates) for 15-minute STEL.

LD<sub>50</sub> for monopropylene glycol:

21000 - 33700 mg/kg oral - rat, >10000 mg/kg skin - rabbit.

May cause slight irritation to skin, eyes and mucous membranes. Large doses may produce adverse effects on liver, kidneys and central nervous system.

No evidence in developmental toxicity studies for either embryotoxic or teratogenic effects.



# SAFETY DATA SHEET

## PRO STEAM SIMULATION FLUID

### 12. Ecological Information

Mobility	Liquid with low volatility, soluble in water, predicted to have high mobility in soil
Persistence and Degradability	The preparation is largely biodegradable: BOD <sub>5</sub> = 1.08 gO <sub>2</sub> /g; ThOD = 1.68 gO <sub>2</sub> /g; COD = 1.63 gO <sub>2</sub> /g BOD <sub>20</sub> /ThOD = 86%
Bio accumulative Potential	Low
Short and long-term effects	LC <sub>50</sub> , fathead minnow = 4600 - 54900 mg/l EC <sub>50</sub> , Daphnia magna = 4850 - 34400 mg/l
Other	

### 13. Disposal Considerations

Substance	Via an authorised waste disposal contractor to an approved waste disposal site, observing all local and national regulations
Container	As for substance. Used containers must not be cut up or punctured until completely purged of product residues

### 14. Transport Information

No special precautions for transport

### 15. Regulatory Information

Supply label details	In accordance with CHIP 2, Regulation 9.
Label Name	Regular DJ
Symbol	} No risk or safety phrases stipulated
Risk phrases	
Safety phrases	
E.E.C. Number	

Use of this material may be governed by the following regulations:

COSHH, HSWA, MHSW

Users are advised to consult these regulations for further information. The information contained in this data sheet does not constitute an assessment of workplace risk as required by other health and safety legislation.

Revision No.: B                      Date:07/06/2007  
Replaces SDS No.:130A              Date:05/09/2006



## SAFETY DATA SHEET PRO STEAM SIMULATION FLUID

### 16. Other Information

No special training is required for handling this preparation other than normal precautions for safe handling of chemicals

This material is usually used for the production of synthetic smoke in an appropriate JEM smoke- machine. The concentration of smoke components is below the OES under normal operating conditions.

It must not be used for any other purpose, or in any other equipment

Further details may be available on request from the supplier, whose address and telephone number are given in section 1.

**This datasheet updated to meet Commission Directive 2001/58/EC**

#### Sources of information:

Suppliers' Safety Data Sheets for substances used as raw materials in the preparation.

EH 40/97

NFPA 325M

#### Legal Disclaimer:

The above information is based on the present state of our knowledge of the product at the time of publication. It is given in good faith, no warranty is implied with respect to the quality of the specification of the product. The user must satisfy himself that the product is entirely suitable for his purpose.

If you have purchased the product for supply to a third party, it is your duty to take all necessary steps to ensure that any person handling and using the product is provided with the information in this sheet. If you are an employer it is your duty to tell your employees and others who may be affected by any hazard described in this sheet and of any precautions that should be taken.

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Replaces SDS No.:130A              Date:05/09/2006

**SDS No. 122B                      Date: June 2007**

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# SAFETY DATA SHEET

## PRO HAZE FLUID

### 1. Identification of the Substance/Preparation & Company/Undertaking

#### 1. Identification of the substance or preparation:

Name: Pro Haze Fluid

Synonyms: Technohaze Fluid

#### 2. Use of the substance/preparation:

Fluid for use in the creation of smoke effects using a dedicated smoke machine.

#### 3. Company/undertaking identification:

Martin Manufacturing (UK) Plc.

Tel: +44 (0) 1507 604399

Belvoir Way,

Fax: +44 (0) 1507 601956

Fairfield Industrial Estate,

Louth,

Lincolnshire,

LN11 0LQ

UK

### 2. Composition/Information on Ingredients

Contains:

Food grade glycols

Polyglycols CAS Registry Number: **57-55-6**

De-mineralised water.

Contains no substances in Part 1 of the Approved Supply List, or with a maximum exposure limit (MEL) specified in Schedule 1 of COSHH.

Contains monopropylene glycol, for which an occupational exposure standard has been set

### 3. Hazardous Information:

No significant hazard to man or environment under normal conditions of handling and use.

Ingestion: low toxicity.

Eye/skin: low toxicity

Inhalation: low concentration of hazardous substances in vapour. Undiluted vapour should not be inhaled. (**Note:** The concentration of smoke components in the final product is below the OES under normal operating conditions)

Revision No.: C

Date:07/06/2007

Replaces SDS No.:114B

Date:05/01/2005



# SAFETY DATA SHEET

## PRO HAZE FLUID

<b>4. First Aid Measures</b>		
<b>Exposure Route</b>	<b>Symptom</b>	<b>Treatment</b>
Inhalation	Mild irritation of nose & throat	Remove from exposure, rest and keep warm. In severe cases, or if recovery is not rapid or complete, seek medical attention
Skin Contact	Mild irritation	Drench the skin with plenty of water. Remove contaminated clothing and wash before re-use. If large areas of the skin are damaged or if irritation persists seek medical attention
Eye Contact	Mild irritation	Irrigate thoroughly with water for at least 10 minutes. Obtain medical attention
Ingestion	Mild irritation of gastro-intestinal tract	Wash out mouth with water. Do not induce vomiting. If patient is conscious, give water to drink. If patient feels unwell seek medical attention.
<b>5. Fire Fighting Measures</b>		
Suitable Extinguishers		Alcohol-resistant or all-purpose-type foam. Use carbon dioxide or dry powder for small fires only
Unsuitable Extinguishers		Do not direct a solid stream of water or foam into hot burning pools; as this may cause frothing and increase the intensity of a fire
Hazardous Combustion Products		Oxides of carbon including aldehydes
Special Equipment for fire Fighting		Self contained breathing apparatus
<b>6. Accidental Release Measures</b>		
Safety Precautions		Wear appropriate PPE when handling - see section 8
Environmental Precautions		Prevent entry into drains and water courses
Clean up Procedure		Bund or absorb material with sand, earth or other suitable absorbent material. If possible, transfer to a salvage tank, otherwise absorb residues and place in suitable labelled containers and hold for waste disposal - see section 13
<b>7. Handling and Storage</b>		
Safe Handling		Avoid prolonged skin contact. Avoid contact with eyes. Ensure good general ventilation of area. Avoid creating spray. Do not breathe undiluted vapour
Storage		Store in original closed containers Store at ambient temperature Store away from materials listed in section 10
Specific Use(s)		Only for use in designated smoke machine for the production of smoke as a special effect

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:114B              Date:05/01/2005

**8. Exposure Controls and Personal Protection**

Exposure Limit Values	Does not exceed 10mg/m <sup>3</sup> for particulate suspension and 474mg/m <sup>3</sup> for total vapour plus particulates.
Exposure Controls:	
Respiratory	Type approved RPE for organic vapours and mists, if required
Hand	PVC coated or rubber gloves
Eye	Goggles or face shield
Skin	Overalls and boots
Hygiene Measures	Always wash thoroughly after handling chemicals

**9. Physical and Chemical Properties**

Appearance:	Colourless Liquid
Odour:	Mild
pH	Neutral
Boiling Point/Range:	101.6 - 201.6 °C
Melting Point/Range:	< -20 °C
Flash Point:	> 78 °C (test flame extinguished at 78 °C)
Flammability Limits:	2.9 - 18.1 v/v (estimated)
Vapour Pressure:	2.67 kPa at 20°C
Relative density:	1.050 at 20 °C/20 °C
Solubility in water:	Completely miscible

**10. Stability and Reactivity**

Stability	Stable in normal conditions
Known hazardous reactions	Possibility of explosive decomposition if combined with strong acids or bases at elevated temperatures
Conditions to avoid	Elevated temperatures
Materials to avoid	Strong acids and bases; strong oxidisers
Hazardous decomposition products	Oxides of carbon, including aldehydes

**11. Toxicological Information**

OES for monopropylene glycol set at 150 ppm (total vapour and particulates) for 8-hour TWA, and 10 mg/m<sup>3</sup> (particulates) for 15-minute STEL.

LD<sub>50</sub> for monopropylene glycol:  
21000 - 33700 mg/kg oral - rat, >10000 mg/kg skin - rabbit.

May cause slight irritation to skin, eyes and mucous membranes. Large doses may produce adverse effects on liver, kidneys and central nervous system.

No evidence in developmental toxicity studies for either embryotoxic or teratogenic effects.



# SAFETY DATA SHEET

## PRO HAZE FLUID

### 12. Ecological Information

Mobility	Liquid with low volatility, soluble in water, predicted to have high mobility in soil
Persistence and Degradability	The preparation is largely biodegradable: BOD <sub>5</sub> = 1.08 gO <sub>2</sub> /g; ThOD = 1.68 gO <sub>2</sub> /g; COD = 1.63 gO <sub>2</sub> /g BOD <sub>20</sub> /ThOD = 86%
Bio accumulative Potential	Low
Short and long-term effects	LC <sub>50</sub> , fathead minnow = 4600 - 54900 mg/l EC <sub>50</sub> , Daphnia magna = 4850 - 34400 mg/l
Other	

### 13. Disposal Considerations

Substance	Via an authorised waste disposal contractor to an approved waste disposal site, observing all local and national regulations
Container	As for substance. Used containers must not be cut up or punctured until completely purged of product residues

### 14. Transport Information

No special precautions for transport

### 15. Regulatory Information

Supply label details	In accordance with CHIP 2, Regulation 9.
Label Name	Regular DJ
Symbol	} No risk or safety phrases stipulated
Risk phrases	
Safety phrases	
E.E.C. Number	

Use of this material may be governed by the following regulations:

COSHH, HSWA, MHSW

Users are advised to consult these regulations for further information. The information contained in this data sheet does not constitute an assessment of workplace risk as required by other health and safety legislation.

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Replaces SDS No.:114B            Date:05/01/2005



## SAFETY DATA SHEET PRO HAZE FLUID

### 16. Other Information

No special training is required for handling this preparation other than normal precautions for safe handling of chemicals

This material is usually used for the production of synthetic smoke in an appropriate JEM smoke- machine. The concentration of smoke components is below the OES under normal operating conditions.

It must not be used for any other purpose, or in any other equipment

Further details may be available on request from the supplier, whose address and telephone number are given in section 1.

**This datasheet updated to meet Commission Directive 2001/58/EC**

#### Sources of information:

Suppliers' Safety Data Sheets for substances used as raw materials in the preparation.

EH 40/97

NFPA 325M

#### Legal Disclaimer:

The above information is based on the present state of our knowledge of the product at the time of publication. It is given in good faith, no warranty is implied with respect to the quality of the specification of the product. The user must satisfy himself that the product is entirely suitable for his purpose.

If you have purchased the product for supply to a third party, it is your duty to take all necessary steps to ensure that any person handling and using the product is provided with the information in this sheet. If you are an employer it is your duty to tell your employees and others who may be affected by any hazard described in this sheet and of any precautions that should be taken.

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:114B              Date:05/01/2005

**SDS No. 114C                      Date: June 2007**

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# SAFETY DATA SHEET

## Heavy Fog C3 FLUID

### 1. Identification of the Substance/Preparation & Company/Undertaking

#### 1. Identification of the substance or preparation:

Name: Heavy Fog C3 Fluid

Synonyms: C3 Fluid

#### 2. Use of the substance/preparation:

Fluid for use in the creation of smoke effects using a dedicated smoke machine.

#### 3. Company/undertaking identification:

Martin Manufacturing (UK) Plc.

Tel: +44 (0) 1507 604399

Belvoir Way,

Fax: +44 (0) 1507 601956

Fairfield Industrial Estate,

Louth,

Lincolnshire,

LN11 0LQ

UK

### 2. Composition/Information on Ingredients

Contains:

Food grade glycols

Polyglycols CAS Registry Number: **57-55-6**

De-mineralised water.

Contains no substances in Part 1 of the Approved Supply List, or with a maximum exposure limit (MEL) specified in Schedule 1 of COSHH.

Contains monopropylene glycol, for which an occupational exposure standard has been set

### 3. Hazardous Information:

No significant hazard to man or environment under normal conditions of handling and use.

Ingestion: low toxicity.

Eye/skin: low toxicity

Inhalation: low concentration of hazardous substances in vapour. Undiluted vapour should not be inhaled. (**Note:** The concentration of smoke components in the final product is below the OES under normal operating conditions)

Revision No.: C

Date:07/06/2007

Replaces SDS No.:117B

Date:05/01/2005

**SDS No. 117C**

**Date: June 2007**

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# SAFETY DATA SHEET

## Heavy Fog C3 FLUID

<b>4. First Aid Measures</b>		
<b>Exposure Route</b>	<b>Symptom</b>	<b>Treatment</b>
Inhalation	Mild irritation of nose & throat	Remove from exposure, rest and keep warm. In severe cases, or if recovery is not rapid or complete, seek medical attention
Skin Contact	Mild irritation	Drench the skin with plenty of water. Remove contaminated clothing and wash before re-use. If large areas of the skin are damaged or if irritation persists seek medical attention
Eye Contact	Mild irritation	Irrigate thoroughly with water for at least 10 minutes. Obtain medical attention
Ingestion	Mild irritation of gastro-intestinal tract	Wash out mouth with water. Do not induce vomiting. If patient is conscious, give water to drink. If patient feels unwell seek medical attention.
<b>5. Fire Fighting Measures</b>		
Suitable Extinguishers		Alcohol-resistant or all-purpose-type foam. Use carbon dioxide or dry powder for small fires only
Unsuitable Extinguishers		Do not direct a solid stream of water or foam into hot burning pools; as this may cause frothing and increase the intensity of a fire
Hazardous Combustion Products		Oxides of carbon including aldehydes
Special Equipment for fire Fighting		Self contained breathing apparatus
<b>6. Accidental Release Measures</b>		
Safety Precautions		Wear appropriate PPE when handling - see section 8
Environmental Precautions		Prevent entry into drains and water courses
Clean up Procedure		Bund or absorb material with sand, earth or other suitable absorbent material. If possible, transfer to a salvage tank, otherwise absorb residues and place in suitable labelled containers and hold for waste disposal - see section 13
<b>7. Handling and Storage</b>		
Safe Handling		Avoid prolonged skin contact. Avoid contact with eyes. Ensure good general ventilation of area. Avoid creating spray. Do not breathe undiluted vapour
Storage		Store in original closed containers Store at ambient temperature Store away from materials listed in section 10
Specific Use(s)		Only for use in designated smoke machine for the production of smoke as a special effect

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:117B              Date:05/01/2005



# SAFETY DATA SHEET

## Heavy Fog C3 FLUID

### 8. Exposure Controls and Personal Protection

Exposure Limit Values	Does not exceed 10mg/m <sup>3</sup> for particulate suspension and 474mg/m <sup>3</sup> for total vapour plus particulates.
Exposure Controls:	
Respiratory	Type approved RPE for organic vapours and mists, if required
Hand	PVC coated or rubber gloves
Eye	Goggles or face shield
Skin	Overalls and boots
Hygiene Measures	Always wash thoroughly after handling chemicals

### 9. Physical and Chemical Properties

Appearance:	Colourless Liquid
Odour:	Mild
pH	Neutral
Boiling Point/Range:	101.6 - 201.6 °C
Melting Point/Range:	< -20 °C
Flash Point:	> 78 °C (test flame extinguished at 78 °C)
Flammability Limits:	2.9 - 18.1 v/v (estimated)
Vapour Pressure:	2.67 kPa at 20°C
Relative density:	1.050 at 20 °C/20 °C
Solubility in water:	Completely miscible

### 10. Stability and Reactivity

Stability	Stable in normal conditions
Known hazardous reactions	Possibility of explosive decomposition if combined with strong acids or bases at elevated temperatures
Conditions to avoid	Elevated temperatures
Materials to avoid	Strong acids and bases; strong oxidisers
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### 11. Toxicological Information

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May cause slight irritation to skin, eyes and mucous membranes. Large doses may produce adverse effects on liver, kidneys and central nervous system.

No evidence in developmental toxicity studies for either embryotoxic or teratogenic effects.

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:117B              Date:05/01/2005



# SAFETY DATA SHEET

## Heavy Fog C3 FLUID

### 12. Ecological Information

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Persistence and Degradability	The preparation is largely biodegradable: BOD <sub>5</sub> = 1.08 gO <sub>2</sub> /g; ThOD = 1.68 gO <sub>2</sub> /g; COD = 1.63 gO <sub>2</sub> /g BOD <sub>20</sub> /ThOD = 86%
Bio accumulative Potential	Low
Short and long-term effects	LC <sub>50</sub> , fathead minnow = 4600 - 54900 mg/l EC <sub>50</sub> , Daphnia magna = 4850 - 34400 mg/l
Other	

### 13. Disposal Considerations

Substance	Via an authorised waste disposal contractor to an approved waste disposal site, observing all local and national regulations
Container	As for substance. Used containers must not be cut up or punctured until completely purged of product residues

### 14. Transport Information

No special precautions for transport

### 15. Regulatory Information

Supply label details	In accordance with CHIP 2, Regulation 9.
Label Name	Regular DJ
Symbol	} No risk or safety phrases stipulated
Risk phrases	
Safety phrases	
E.E.C. Number	

Use of this material may be governed by the following regulations:

COSHH, HSWA, MHSW

Users are advised to consult these regulations for further information. The information contained in this data sheet does not constitute an assessment of workplace risk as required by other health and safety legislation.

Revision No.: C      Date:07/06/2007  
Replaces SDS No.:117B      Date:05/01/2005

**SDS No. 117C      Date: June 2007**

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# SAFETY DATA SHEET

## Heavy Fog C3 FLUID

### 16. Other Information

No special training is required for handling this preparation other than normal precautions for safe handling of chemicals

This material is usually used for the production of synthetic smoke in an appropriate JEM smoke- machine. The concentration of smoke components is below the OES under normal operating conditions.

It must not be used for any other purpose, or in any other equipment

Further details may be available on request from the supplier, whose address and telephone number are given in section 1.

**This datasheet updated to meet Commission Directive 2001/58/EC**

#### Sources of information:

Suppliers' Safety Data Sheets for substances used as raw materials in the preparation.

EH 40/97

NFPA 325M

#### Legal Disclaimer:

The above information is based on the present state of our knowledge of the product at the time of publication. It is given in good faith, no warranty is implied with respect to the quality of the specification of the product. The user must satisfy himself that the product is entirely suitable for his purpose.

If you have purchased the product for supply to a third party, it is your duty to take all necessary steps to ensure that any person handling and using the product is provided with the information in this sheet. If you are an employer it is your duty to tell your employees and others who may be affected by any hazard described in this sheet and of any precautions that should be taken.

Revision No.: C                      Date:07/06/2007  
Replaces SDS No.:117B              Date:05/01/2005

**SDS No. 117C                      Date: June 2007**

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