Worker Injured During Explosion

Date of Incident: 99 04 27
Type of Incident: Fatality

SUMMARY

On 99 04 27 a worker was welding a splashguard on a portable tar tank that contained a flammable liquid residue. Welding caused the flammable liquid residue inside the tar tank to ignite and explode. The worker was critically injured when he was struck with a service lid on his facial area. The injured worker was transported to the Red Deer Regional Hospital where he was pronounced dead.

The direct cause of the incident was that the worker performed welding on a tar tank that contained a flammable liquid residue. The contributing factors were inadequate hazard assessment prior to starting welding, poor hazard communication and worker's training.

Workplace Health and Safety commenced an investigation on 99 04 27 after being notified by the RCMP. A stop work order regarding welding operations was issued to the employer. Additionally the employer was directed to evaluate fire hazards, develop safe work procedures for welding operations and conduct an incident investigation.

Following the incident, the company retained a consultant to evaluate fire and explosion hazards, develop safe work procedures for welding operations and implement a comprehensive Health and Safety Program.

The employer had complied with all orders issued by Workplace Health and Safety and submitted an incident investigation report.

File: F-267801

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1.1 267801

Section 2.0 DATE AND TIME OF INCIDENT

2.1 99 04 27, 13:53

Section 3.0 DATE AND TIME OF INVESTIGATION

3.1 99 04 27, 14:28

Section 4.0 NAME OF INVESTIGATOR(S) (INTERNAL)

4.1 Wolfgang Richter, CRSP, Workplace Health and Safety Officer

Section 5.0 INCIDENT REPORTED BY

5.1 RCMP, Red Deer Rural Detachment

Section 6.0 DATE AND TIME INCIDENT WAS REPORTED

6.1 99 04 27, 14:28

Section 7.0 NAME & ADDRESS OF PRINCIPAL STAKEHOLDER(S)

7.1 **Owner(s)**

7.1.1 Marshall Brothers Construction Ltd.
139, 37565 Hwy 2
Red Deer County, Alberta
T4E 1B4

7.2 **Prime Contractor**

7.2.1 See 7.1

7.3 **Employer**

7.3.1 See 7.1

Section 8.0 DESCRIPTION OF PRINCIPAL OWNER(S) OR EMPLOYER(S)

8.1 Marshall Brothers Construction Ltd. builds cement foundations and applies tar sealant for the residential construction industry. The company has been in business for 13 years. The company had 35 employees at the time of incident.

Section 9.0 LOCATION OF INCIDENT

9.1 The incident occurred at 139, 37565 Hwy 2, Red Deer County, Red Deer, Alberta (Refer Attachment A, Map).

Section 10.0 EQUIPMENT AND MATERIAL INVOLVED

10.1 A portable tar tank involved in the incident was 0.88 metres long, 0.73 metres wide and 1.4 metres high, and had a capacity of 956 litres. A service lid about 32.5 centimetres by 52.5 centimetres with a filler spout was installed on the top of the tar tank. About 40.0 litres of RC Special Asphalt liquid residue was left over in the tar tank from the previous use (Refer Attachment B, Sketch 1; Attachment C, Photographs 1 & 2 and Attachment D).

10.2 Flatbed truck used to take the portable tar tank to the sites (Refer Attachment B, Photograph 3).

10.3 Three pieces of flat iron, about 10.0 centimetres wide, were used for splashguards (Refer Attachment B, Sketch 1 and Attachment C, Photographs 1 & 2).

10.4 An electric arc welding unit with a voltage of 28 Volts and current of 200 Amps was used to weld splashguards (Refer Attachment B, Photograph 1).

10.5 The worker was wearing cotton coveralls, leather gloves and a welding helmet.

Section 11.0 NAMES OF OTHER INVESTIGATORS (EXTERNAL)

11.1 RCMP, Red Deer Rural Detachment

11.2 Alberta Transportation & Utilities
Red Deer, Alberta

Section 12.0 NARRATIVE DESCRIPTION OF INCIDENT

12.1 The co-owner and the workers decided to weld a splashguard, around the three sides, at the top of a portable tar tank to contain overflow that occurred during previous filling. The tank was located outside the shop in the yard area.

12.2 On 99 04 27, 13:00, worker A and worker B brought welding equipment and materials from the shop and set it up to weld splashguards on the tank.

12.3 The portable tar tank had about 40.00 litres of RC Special Asphalt liquid residue left over from the previous use. Worker A, worker B and the co-owner discussed the potential fire and explosion hazards while welding on a tank that contained liquid residue. It was not clear who made the decision but they proceeded to weld the splashguards on a tar tank.

12.4 At 13:30, worker A began welding and worker B was assisting him to hold the splashguard on the top of a portable tar tank. Worker A continued to weld and worker B went to the shop to get paint and supplies.

12.5 At 13:53, worker A was on the top of the tank and was welding the last 10 centimetres of the splashguard closest to the service lid. Worker B returned from the shop and started cleaning the welds on the splashguards for painting. The liquid residue in the tar tank ignited and exploded. The service lid, complete with filler spout blew upward and struck worker A on his facial area. Worker B who was standing on the ground fell backward with the explosion thrust.

12.6 Worker B administered basic first aid services to worker A and asked another worker to call EMS.

12.7 The EMS arrived at the scene within 8 minutes. The injured worker was transported to the Red Deer Regional Hospital where he was pronounced dead at 14:37.

Section 13.0 CONCLUSIONS

13.1 **Direct Causes:**

The direct cause of the incident was that the welding was performed on the portable tar tank that contained a flammable liquid residue.

13.2 **Indirect Causes:**

The co-owner and the workers did not recognise the seriousness of the fire and explosion hazards present while welding on a tank that contained a flammable product. The co-owner and the workers did not stop work after discussing the potential fire and explosion hazards.

The employer did not have any written safe work procedures for welding operations. The information regarding the fire and explosion hazards on the Material Safety Data Sheet was not discussed and communicated to the workers.

The worker had thirty years of experience in maintenance and welding. However, he was not a registered Journeyman welder as required in the province of Alberta. The employer did not verify competency of the worker by checking his welding certification.

13.3 The incident may have been prevented if the tank was properly cleaned to remove all flammable liquid residues and purged with air prior to welding.

Section 14.0 FOLLOW-UP/ACTION TAKEN

14.1 Industry

14.1.1 The employer had complied with all the orders issued by Workplace Health and Safety. The employer had investigated the incident and submitted the incident investigation report to Workplace Health and Safety.

14.1.2 The employer had taken the damaged tar tank out of service. The company currently utilises a newly manufactured tank certified by a professional engineer.

14.1.3 Following this incident, the employer hired a Health and Safety Consultant who is presently developing and implementing a comprehensive Health and Safety Program.

14.2 Workplace Health and Safety

14.2.1 Workplace Health and Safety commenced an incident investigation on 99 04 27 after being notified by the RCMP.

14.2.2 Workplace Health and Safety issued a stop work order regarding welding operations to the employer. Additionally the employer was directed to evaluate fire and explosion hazards, develop safe work procedures for welding operations and conduct an incident investigation.

14.3 Additional Measures

14.3.1 The employer is working towards achieving a Certificate of Recognition with the Alberta Construction Safety Association.

Section 15.0 INJURY SEVERITY

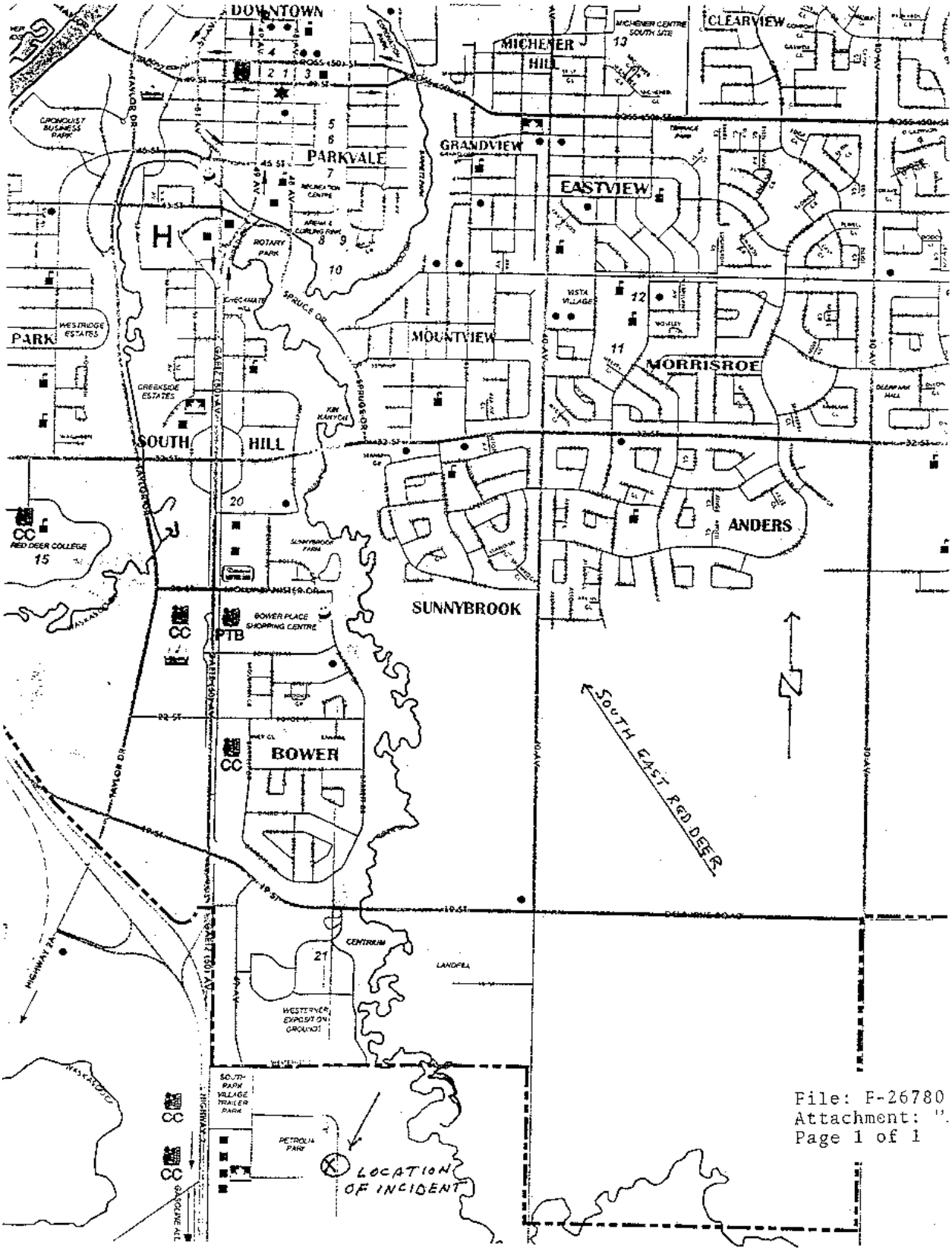
15.1 A worker sustained fatal head injuries.

Section 16.0 SIGNATURES

[original signed]

Section 17.0 ATTACHMENTS

Attachment “A”	Map
Attachment “B”	Sketch
Attachment “C”	Photographs
Attachment “D”	MSDS



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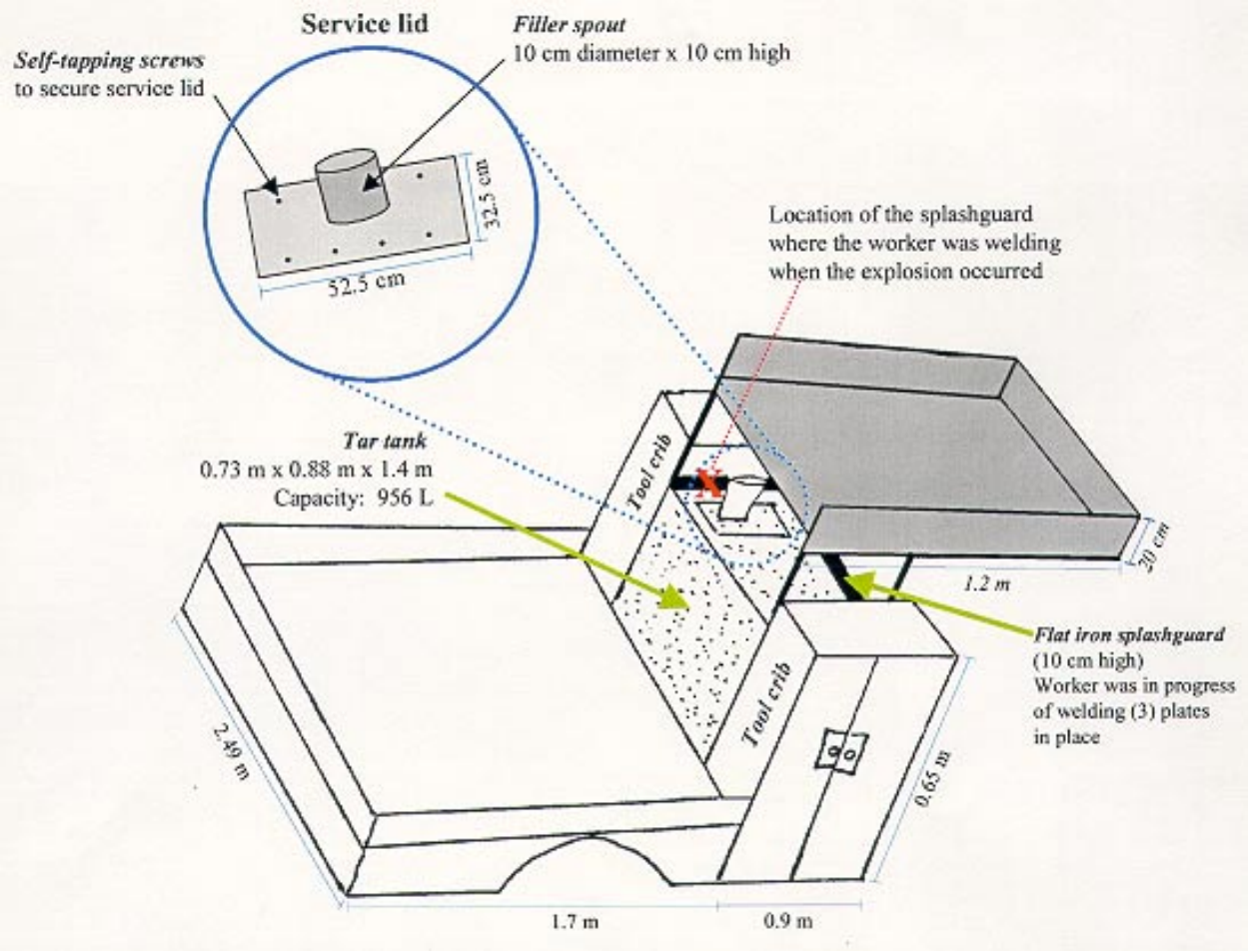

Sketch 1: **Shows tar tank assembly**
(Not to scale)

Photograph #1 – Shows an overview of the portable tar tank unit.

- The tar tank unit was built approximately twelve years ago in Red Deer. No information was available regarding specifications and individual who built it.
- Blue arrow [right side, upper arrow]indicates an acetylene bottle used to cut flat iron to build a splashguard around three sides on top of the tar tank. This equipment was not in use at the time of the explosion.
- Red arrow [right side, lower arrow] indicates an electric arc welder that was in use to weld the splashguard at the time of the explosion.
- Green arrow [left] indicates the position of the worker with his face up after the explosion.

Photograph #2

- Green arrow [upper, left] shows the splashguard that the worker was welding at the time of the explosion.
- Red arrow [lower, left] shows the service lid that blew upward from the tar tank during explosion and struck the worker in his facial area. Blue arrow [upper, right] shows the location of opening on the tank where the service lid was secured by eight self-tapping screws.
- It could not be determined whether the filler spout was closed at the time of explosion.
- Approximately 7 cm of tar product was at the bottom of the tank, when the explosion occurred. The capacity of the tank was approximately 956 L.
- The worker was wearing a welding shield, cotton coveralls and work gloves at time of the incident.

Photograph #3 – The flatbed truck used to transport the portable tar tank to the construction sites. The tank was not mounted on the back of the truck at the time of the explosion.

Imperial Oil Esso L'Impériale

TO/À	FAXBACK
DATE: 3 May 1999	PLEASE INDICATE CHANGES AND MAIL/FAX TO OUR ADDRESS BELOW NOUS AVISER DE TOUT CHANGEMENT PAR COURRIER OU PAR FAX (ADRESSE CI-DESSOUS)
ATTENTION:	ATTENTION:
COMPANY/COMPAGNIE:	COMPANY/COMPAGNIE:
ADDRESS/ADRESSE:	ADDRESS/ADRESSE:
CITY/VILLE:	CITY/VILLE:
FAX NO./N° DE FAX: (403) 343 - 3061	FAX NO./N° DE FAX:
PHONE NO./N° DE TÉLÉPHONE: (XXX) XXX -	PHONE NO./N° DE TÉLÉPHONE:
LANGUAGE PREFERENCE/LANGUE DE CORRESPONDANCE:	LANGUAGE PREFERENCE/LANGUE DE CORRESPONDANCE:
ENG/ANG: X FR/FR: BOTH/LES DEUX:	ENG/ANG: FR/FR: BOTH/LES DEUX:

FROM/DE

IOL FAXBACK SYSTEM
CUSTOMER SERVICE
90 WYNFORD DR.
NORTH YORK, ONTARIO
FAX NUMBER:416-441-7829
PHONE NUMBER:800-IOL-MSDS

MESSAGE

ONE OF OUR PRIORITIES IS TO KEEP OUR CUSTOMERS ABREAST OF HEALTH AND SAFETY INFORMATION REGARDING THE USE OF OUR PRODUCTS IN THE WORKPLACE.
PLEASE FIND ATTACHED, OUR MOST CURRENT MATERIAL SAFETY DATA SHEET (MSDS).

PLEASE REPLACE ANY PREVIOUS SHEETS WITH THE ATTACHED VERSIONS.
IT IS IMPERATIVE THAT THIS NEW INFORMATION BE COMMUNICATED, AS APPROPRIATE, TO YOUR EMPLOYEES AND/OR CUSTOMERS.
SHOULD YOU EXPERIENCE ANY DIFFICULTY WITH THIS FAX TRANSMISSION, OR HAVE RECEIVED IT BY ERROR, PLEASE NOTIFY THE SENDER BY CALLING THE ABOVE NUMBER.
WE ALSO WOULD ASK YOUR HELP IN KEEPING OUR RECORDS CURRENT.
IF THE ABOVE INFORMATION REQUIRES ANY REVISION, COMPLETE THE FAXBACK AREA ON THIS LETTER AND RETURN IT TO US AT THE ABOVE ADDRESS OR FAX NUMBER.

YOUR BUSINESS IS APPRECIATED AND WE WILL CONTINUE TO SUPPLY QUALITY PRODUCTS AND SERVICES, ALONG WITH INFORMATION TO ASSIST YOU IN YOUR EFFORTS TO MAINTAIN A HEALTHY AND SAFE WORKPLACE.
PRODUCTS WITH (OBSOLETE) AS SUFFIX ARE NO LONGER MANUFACTURED OR SOLD.*

MSDS INCLUDED/FS INCLUSE(S)

RC SPECIAL ASPHALT

Esso Imperial Oil

MATERIAL SAFETY DATA SHEET

Date Prepared: April 21, 1999
Supersedes: April 21, 1998
MSDS Number: 08452

Cette fiche signalétique est aussi disponible en français

1. PRODUCT INFORMATION

Product Identifier: RC SPECIAL ASPHALT

Application and Use:
Solvent cutback asphalt

Product Description:

A complex mixture of hydrocarbons, a blend of asphalt and petroleum distillates.

REGULATORY CLASSIFICATION

WHMIS:

Class B, Division 2: Flammable Liquids
Class D, Division 2, Subdivision B: Toxic Material

CEPA: CANADIAN ENVIRONMENTAL PROTECTION ACT

All components of this product are either on the Domestic Substances List (DSL) or are exempt.

TDG INFORMATION (RAIL/ROAD):

Shipping Name: TARS, LIQUID
Class: 3
Packing Group: II
PIN Number: UN1999

Please be aware that other regulations may apply.

TELEPHONE NUMBERS

Emergency 24 hr (519) 339-2145
Technical Info. (800) 268-3183

MANUFACTURER/SUPPLIER:

IMPERIAL OIL
Products Division
111 St Clair Avenue West
Toronto, Ontario
M5W 1K3
(416) 968-4441

2. REGULATED COMPONENTS

The following components are defined in accordance with sub-paragraph 13(a)(i) to (iv) or paragraph 14(a) of the Hazardous Products Act:

NAME	%	CAS #
Heavy naphtha	30-60 v/v	64741-41-9

3. TYPICAL PHYSICAL & CHEMICAL PROPERTIES

Physical State: Liquid
Specific gravity: not available
Viscosity: 20.00 cSt at 60 deg C
Vapour Density: not available
Boiling Point: 80 to 360 deg C
Evaporation rate: < 1 (1= n-butylacetate)
Solubility in water: negligible
Freezing/Pour Point: not available
Odour Threshold: not available
Vapour Pressure: 3 kPa at 38 deg C
Density: 0.90 g/cc at 15 deg C
Appearance/odour: Black liquid

4. HEALTH HAZARD INFORMATION

NATURE OF HAZARD

INHALATION:

Low toxicity.
Elevated temperatures or mechanical action may form vapours, mists or fumes which may affect various internal body systems.
It is possible for the toxic gas hydrogen sulphide to build up in tanks or other confined spaces that contain this product. Although the gas smells like rotten eggs at low concentrations, it may cause irritation, respiratory collapse, coma and death without necessarily any warning odour being sensed.
Avoid breathing vapours or mists.

EYE CONTACT:

Slightly irritating, but will not injure eye tissue.

SKIN CONTACT:

Exposure to hot material may cause thermal burns.
Low toxicity.
Frequent or prolonged contact may irritate the skin and cause a skin rash (dermatitis).
Certain components present in this material may be absorbed through the skin in toxic quantities.

INGESTION:

Low toxicity.

CHRONIC:

Contains benzene. Human health studies (epidemiology) indicate that prolonged and/or repeated overexposures to benzene may cause damage to the blood producing system and serious blood disorders, including leukemia.
Animal tests suggest that prolonged and/or repeated overexposures to benzene may damage the embryo/fetus. The relationship of these animal studies to humans has not been fully established.
Contains n-hexane. Prolonged and/or repeated exposures may cause damage to the peripheral nervous system (e.g. fingers, feet, arms etc.).

ACUTE TOXICITY DATA:

Based upon animal test data from similar materials and products, the acute toxicity of this product is expected to be:
Oral : LD50 > 5000 mg/kg (Rat)
Dermal : LD50 > 2000 mg/kg (Rabbit)

OCCUPATIONAL EXPOSURE LIMIT:

Manufacturer recommends:
For Benzene (skin) 1 ppm TWA for 8 hour workday.

ACGIH recommends:
For Benzene, ACGIH recommends a TWA of 0.5 ppm (1.6 mg/m3), (skin), and categorizes it as a confirmed human carcinogen.
For Asphalt (petroleum) fumes, 5 mg/m3.
For Hydrogen Sulphide, 10 ppm (14 mg/m3).
For n-Hexane (skin), 50 ppm (176 mg/m3); for other hexane isomers, 500 ppm (1760 mg/m3).

Local regulated limits may vary.

5. FIRST AID MEASURES

INHALATION:

In emergency situations use proper respiratory protection to immediately remove the affected victim from exposure. Administer artificial respiration if breathing has stopped. Keep at rest. Call for prompt medical attention.

EYE CONTACT:

Flush eyes with large amounts of water until irritation subsides. If irritation persists, get medical attention.

SKIN CONTACT:

For hot material, immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.
For hot material, no attempt should be made to remove material from skin or to remove contaminated clothing as the damaged flesh may easily be torn. Transport individual to a medical facility for treatment.

Immediately flush with large amounts of water. Use soap if available. Remove contaminated clothing, including shoes, after flushing has begun. If irritation persists, seek medical attention.

INGESTION:

If swallowed, DO NOT induce vomiting. Keep at rest. Get prompt medical attention.

6. PREVENTIVE AND CORRECTIVE MEASURES

PERSONAL PROTECTION:

The selection of personal protective equipment varies, depending upon conditions of use.

Please turn over

Esso Imperial Oil

MATERIAL SAFETY DATA SHEET

In open systems where contact is likely, wear safety goggles, chemical-resistant overalls, and chemically impervious gloves.
Where only incidental contact is likely, wear safety glasses with side shields. No other special precautions are necessary provided skin/eye contact is avoided.
Where concentrations in air may exceed the occupational exposure limits given in Section 4 and where engineering, work practices or other means of exposure reduction are not adequate, approved respirators may be necessary to prevent overexposure by inhalation.

ENGINEERING CONTROLS:

The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fumehood. Provide mechanical ventilation of confined spaces.
Use explosion-proof ventilation equipment.

HANDLING, STORAGE AND SHIPPING:

Keep containers closed. Handle and open containers with care.
Store in a cool, well ventilated place away from incompatible materials.
In keeping with good personal hygiene practices, wash hands thoroughly after handling the material.
Store and load at normal (up to 38 deg C) temperature and at atmospheric pressure.
Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not reuse empty containers without commercial cleaning or reconditioning.

LAND SPILL:

Eliminate source of ignition. Keep public away. Prevent additional discharge of material, if possible to do so without hazard.
Prevent spills from entering sewers, watercourses or low areas. Contain spilled liquid with sand or earth. Do not use combustible materials such as sawdust.
Recover by pumping (use an explosion proof motor or hand pump), or by using a suitable absorbent.
Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately.
Take all additional action necessary to prevent and remedy the adverse effects of the spill.

WATER SPILL:

Remove from surface by skimming or with suitable absorbents. If allowed by local authorities and environmental agencies, sinking and/or suitable dispersants may be used in unconfined waters.
Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately.
Take all additional action necessary to prevent and remedy the adverse effects of the spill.

7. FIRE AND EXPLOSION HAZARD

Flashpoint and method: 0 deg C TOC ASTM D1310

Autoignition: NA Flammable Limits: LEL: 0.8% UEL: 6.0%

GENERAL HAZARDS:

Flammable Liquid; may release vapours that form flammable mixtures at or above the flash point.
Toxic gases will form upon combustion.
Static Discharge; material may accumulate static charges which may cause a fire.

FIRE FIGHTING:

Use water spray to cool fire exposed surfaces and to protect personnel.
Shut off fuel to fire if possible to do so without hazard. If a leak or spill has not ignited use water spray to disperse the vapours.
Either allow fire to burn out under controlled conditions or extinguish with foam or dry chemical. Try to cover liquid spills with foam.
Respiratory and eye protection required for fire fighting personnel.
Avoid spraying water directly into storage containers due to danger of boilover.
A self-contained breathing apparatus (SCBA) should be used for all indoor fires and any significant outdoor fires. For small outdoor fires, which may easily be extinguished with a portable fire extinguisher, use of an SCBA may not be required.

HAZARDOUS COMBUSTION PRODUCTS:

Smoke, carbon monoxide, carbon dioxide and traces of oxides of sulphur.

8. REACTIVITY DATA

STABILITY:

This product is stable. Hazardous polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID:

Strong oxidizing agents.

HAZARDOUS DECOMPOSITION:

none.

9. NOTES

All components of this product are listed on the U.S. TSCA inventory.

This MSDS has been revised in Section 4.
Occupational Exposure Limit change.

10. PREPARATION

Date Prepared : April 21, 1999
Prepared by: Lubricants & Specialties
IMPERIAL OIL
Products Division
111 St Clair Avenue West
Toronto, Ontario
M5W 1K3
(800) 268-3183

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