Hazardous Material Replacement

Kansas City Division

Aysun H. Guttridge

KCP-613-5230

Published September 1993

Final Report

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HAZARDOUS MATERIAL REPLACEMENT

Aysun H. Guttridge

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Final Report

Aysun H. Guttridge, Project Leader

Technical Communications
Kansas City Division

AlliedSignal
A E R O S P A C E

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Abstract

Methyl dianiline (MDA) is one of the components used in potting of electronic assemblies at AlliedSignal Inc., Kansas City Division (KCD). MDA is a liver toxin and a suspected carcinogen. The KCD has made a commitment to eliminate the use of hazardous materials as much as technically feasible. This project was initiated to find alternatives to the MDA foam system. The project plan was to verify that the new materials developed by expert groups within the DOE nuclear weapons complex, such as the Organic Materials Group, would meet the unique requirements of the assemblies fabricated in the Electronic Products Manufacturing Building (EPMB) at KCD. The work was discontinued when associates assigned to the project were transferred to higher priority projects.

Summary

Methyl dianiline (MDA) is one of the components of curing agent Z (MS4604085), which is used in potting of cables and electronic assemblies. MDA is a suspected carcinogen, and the Occupational Safety and Health Administration (OSHA) has proposed regulation to control its use. In anticipation of this regulation, KCD has implemented controls to minimize the exposure and hazard of MDA to operating personnel. In addition, KCD has made a commitment, as much as technically feasible, to eliminate the use of all materials that are hazardous to personnel or the environment.

As part of the effort to minimize the use of hazardous materials, extensive work has been done, both by KCD and others in the nuclear weapons complex, to find an alternative to MDA. Ethacure 100 was selected as a potential replacement to MDA. Recent studies have shown, however, that Ethacure 100 may also be a potential carcinogen. One alternative to Ethacure 100 identified by the Organic Materials Group is an anhydride foam

system that had been proposed as a replacement for MDA. The Organic Materials Group includes personnel from a number of agencies within the nuclear weapons complex.

This development project was initiated to evaluate the anhydride system in cables and other electronic assemblies and to verify that the anhydride system would meet the unique requirements of the EPMB products. In addition, the process would be developed to ensure that it could be used in a manufacturing environment. The plan consisted of building electronic assemblies and components that are representative of the type manufactured in the EPMB to prove in the process.

Although the fabrication of the electronic components had been initiated, this project was discontinued before completion because personnel were transferred to higher priority assignments. This report outlines what the project had planned to accomplish and describes the work completed to date.

Discussion

Scope and Purpose

Methyl dianiline (MDA) is one of the components of curing agent Z (MS4604085) which is used in potting of cables and electrical assemblies fabricated in the Electrical Products Manufacturing Building (EPMB) at KCD. MDA is a liver toxin and a suspected carcinogen to humans. OSHA has proposed regulation to control its use. In anticipation of this regulation, AlliedSignal Inc., Kansas City Division (KCD), has initiated controls to minimize the exposure and hazard of MDA to operating personnel. In addition, KCD is working with Sandia National Laboratories (SNL) and other agencies in the nuclear weapons complex (NWC) to find a suitable alternative to foam systems using MDA.

There are a number of task groups in the NWC working on ES&H issues to ensure that there is no duplication of effort and that the ES&H concerns are handled effectively. The Organic Materials Group has been addressing the MDA replacement issue, and extensive work has been done, both by KCD and others in the NWC, to find a suitable alternative to MDA.

This development project was initiated to work with the Organic Materials Group and the KCD Materials Engineering Department in providing input on the unique requirements of the EPMB products and to tailor an alternative foam potting system recommended by the group to the EPMB product requirements. This project would test the materials identified by building representative electronic assemblies to verify that the unique requirements are met.

Activity

Technical Plan

The project plan included the following six steps.

1. Identify the unique requirements of the EPMB products and communicate these requirements to the expert groups such as the Organic Materials Group and the KCD Materials Engineering Department.
2. Obtain recommendations from the expert groups on the material to use and then build electronic assemblies using the recommended material.
3. Select electronic components that would be representative of the types of products fabricated at the EPMB to evaluate the material recommended by the expert groups.
4. Build components with the new material and compare these results with those obtained from components built using the MDA foam system.
5. Carry out functional testing on the electronic assemblies to evaluate the new material and process.
6. Design and carry out a long-term aging study to evaluate how the new material would endure in the stock-pile. Use the components built with the current material as a control group.

The plan includes first to develop a list of unique requirements of the EPMB products

and then to communicate these requirements to the Organic Materials Group and the KCD Materials Engineering Department. A product that would be considered representative of the EPMB product would then be fabricated using the formulation recommended by the Organic Materials Group. The fabricated product would then be inspected according to normal WR criteria. Because endurance in stockpile is an important requirement, a long-term aging study was also included in the project plan to ensure that the potting materials do not degrade with time.

The goal of this project was to work toward elimination of MDA by July 1993, which is the date by which SNL, KCD, and DOE jointly agreed that use of all hazardous materials would be eliminated as much as technically feasible.

Special Product Requirements

The foam system being developed is for potting of electrical assemblies. It is necessary for the foam system to have good mechanical and electrical properties. These properties will be evaluated by the members of the Organic Materials Group, and that evaluation is outside the scope of this project. Figure 1 is a summary of properties typically tested in evaluating a foam system. This project will focus on processing of the foam system and functional testing of the electrical assemblies that are typically fabricated in the EPMB.

Foam Selection

When new information became available about Ethacure 100, the Organic Materials Group began working on a new foam system formulation. This system was a four-part anhydride system. The anhydride has a high coefficient of thermal expansion and low viscosity. In an electrical assembly, both are undesirable

characteristics. To counter the high coefficient of thermal expansion, the material scientists at SNL increased the loading level of the foam. At higher loading levels, the processing of the foam system becomes more difficult. The recommended formulation developed by SNL is shown in Table 1.

Material safety data sheets on the curing agent, HHPA, and the epoxy, Epon 826, are included in the Appendix of this report.

EPMB Product Qualification

A survey showed that curing agent Z is used on two types of EPMB products: filter packs and cables. It was decided that a filter pack (fairly representative of the typical filter packs) and a cable would be built to prove in the anhydride system. The functional testing of the anhydride system could be extrapolated to the other products built in the EPMB.

Work orders were initiated to build three each of both types of products. Because these parts are in the WR system, there is enough functional data available to compare the MDA foam system to the new anhydride foam system. It was agreed that, to save the cost of building three control units, the information on file on the MDA for the WR parts would be used as the baseline. To ensure that the units potted with the anhydride system would compare with the units built for WR use, the same functional tests would be used to evaluate the anhydride potted units.

Accelerated Aging

To verify that the anhydride system would endure stockpile life, the components would be subjected to accelerated aging. Discussions were carried out with the KCD Statistical Services Group and the Materials Engineering Department to design a long-term aging study. It was

- I. Tensile Properties (ASTM D638)
 - A. Tensile strength, elongation, and modules
 - 1. Test conditions
 - a. Test five tensile bar samples at each test temperature
 - b. Use test temperatures of -65°F, room temperature, 165°F, and 260°F
- II. Electrical Properties
 - A. Volume resistivity (ASTM D257)
 - 1. Test Conditions
 - a. Test five dielectric disks total
 - b. Take readings at room temperature, 150°F, 250°F, and 350°F
 - B. Dielectric constant, dissipation factor, and dielectric strength (ASTM D150 and D149)
 - 1. Test conditions
 - a. Test five dielectric disks total
 - b. Measure dielectric constant and dissipation factor at frequencies of 100 Hz, 10 kHz, and 1 MHz
 - c. Measure dielectric strength on samples after dielectric constant and dissipation factor have been determined
- III. Thermal Properties
 - A. Coefficient of thermal expansion (ASTM D696)
 - 1. Test conditions
 - a. Test three 4 in. x 0.450-0.475 in. OD rod specimens
 - b. Run tests between -65 and 260°F
 - c. Report average second cycle values for temperature ranges of -65 to 70°F, 70 to 165°F, and 165 to 260°F
 - B. Glass transition temperature by TMA (no ASTM available)
 - 1. Test conditions
 - a. Test three tensile bar ends
 - b. Use a heating rate of 5°C per minute
- IV. Miscellaneous Properties
 - A. Density (ASTM D792)
 - 1. Test conditions
 - a. Test five tensile bar ends
 - B. Crucible ash content (no ASTM available)
 - C. Carbon, hydrogen, and nitrogen content (Leco analyzer)

Figure 1. Proposed Test Scheme

Table 1. Formulation of Anhydride

Name	Stores Number	Parts by Weight
Epon 826	2140385	100
HHPA	4622052	80
Polyol 1025	57003844	30
EMI-24	57003848	4

agreed that the aging would be accelerated by placing the components in an oven at 160°F.

Accomplishments

A survey of the EPMB products was done to determine their unique requirements. The anhydride system was recommended as a viable alternative to the MDA foam system. Work orders were initiated to build three of each type of product group using the new anhydride foam system. The work was stopped when personnel doing the work were transferred to other assignments.

Future Work

OSHA has not gone through with the proposed regulation of MDA. There needs to be further evaluation carried out to ensure that the curing agent Z is indeed hazardous. If studies show that this material is hazardous, then the search for alternatives to MDA should continue.

Appendix

Material Safety Data Sheets

ANHYDRIDES AND CHEMICALS INCORPORATED

7-33 AMSTERDAM STREET, NEWARK, NEW JERSEY 07105(201)465-0077

HEXAHYDRO PHTHALIC ANHYDRIDE

Hexahydro Phthalic Anhydride (HHPA) is an anhydride hardener for epoxy resins. It is used as a molten liquid at temperatures slightly above room temperature. HHPA provides castings and impregnating formulations of outstanding electrical properties and exterior durability. Mechanical properties and chemical resistance of the cured products are also excellent.

Specifications:

Molecular Weight	154
Solidification Point	34.0°C Min.
Iodine Value	1.0 Max.
Neutralization Value	710-740
Color (APHA)	50 Max.

Typical Formulation:

Parts by Weight

Epoxy Resin (Epoxy Equivalent 175-210)	100
HHPA	80
BDMA (Benzyl Dimethyl Amine)	1

Gel at 100°C or lower for 1-2 hours. Post cure at 130°-150°C for 3-8 hours.

Properties: (at cure schedule: 100°C - 2 hours, 130°C - 5 hours)

HDT, °C	120
Tensile Strength, psi	11,000
Elongation, %	4
Flexural Strength, psi	17,500
Compressive Strength, psi	17,300
Hardness (Barcol)	40
Dielectric Constant, 25°C 60 cy	3.3
10 ⁶ cy	3.1

M A T E R I A L S A F E T Y D A T A S H E E T

ANHYDRIDES & CHEMICALS, INC.

7-33 Amsterdam Street

Newark, NJ 07105

Phone: 201-465-0077

IDENTITY

Name: Hexahydro Phthalic Anhydride, HHPA Formula: $C_8H_{10}O_3$ CAS: 85-42-7
Chemical Family: Anhydride

PHYSICAL DATA

Boiling Point, 17 mm Hg: 158°C Melting Point: 37.0°C
Vapor Pressure: 5 mm Hg at 105°C Vapor Density (air=1): 5.31
Specific Gravity: 1.19 at 40°C Density: 9.8 lbs/gal at 40°C
Solubility in Water: Hydrolyzes.
Appearance & Odor: Fused solid. Sharp, acrid odor when hot.

FIRE & EXPLOSION DATA

Flash Point: 145°C Open Cup. Flammable Limits: Not known
Special Firefighting Instruction and Equipment: Respiratory protection
against vapors and combustion products.
Fire & Explosion Hazards: Vapors and fumes can cause respiratory problems.
Keep away from water, ammonia fumes.

REACTIVITY DATA

Stability: Stable at ambient temperatures. Decomposition Temperature: 380°C
Conditions to avoid: Excessive temperatures.
Incompatibility: Avoid water, acid, base, oxidizers.
Hazardous Decomposition Products: CO_2 , dodecahydroanthraquinone,
hydrogenated anthracenes.
Hazardous Polymerization: May occur at high temperatures.

SPILL OR LEAK PROCEDURES

Clean up spills promptly. Avoid contact. Ventilate confined areas. If
molten, allow to cool and solidify. Pick up solid material.
Disposal: Deposit in a separate, labelled, leak proof container and take
to an approved treatment, storage, or disposal facility.

HEALTH HAZARD DATA

Classification: Sensitizer, eye hazard.
Toxicity & Sensitivity Data:
Ingestion Oral LD₅₀: Rat 3307 mg/kg.
Absorption Dermal LD₅₀: Rabbit greater than 2000 mg/kg.
Primary Routes of Entry: Inhalation, eyes, skin.
Signs and Symptoms of Exposure: Eye irritation, inflammation. Skin rash,
dermatitis.

EMERGENCY & FIRST AID

In case of contact get medical attention. Inhalation: Remove person to
fresh air. Skin/Eye Contact: Flush skin or eyes with water for at
least 15 minutes, remove contaminated clothing. Ingestion: If
person is conscious, give water or milk to dilute; do not induce
vomiting.

PERSONAL PROTECTIVE EQUIPMENT

Wear dust/organic vapor respirator in concentration is high. Safety glasses
with side shield, or full face shield where appropriate. Provide
adequate ventilation.

FSCM NO. 14213
FCO882274BX
R. S. Sanders BX837
A. T. Oravec SNLA 2833

4622052
-00
PAGE 1 OF 4

CURING AGENT, HEXAHYDROPHTHALIC ANHYDRIDE

PAGE 1 2 3 4
ISSUE F F F F

Drawing Callout: Hexahydrophthalic Anhydride per 4622052-(1).

(1)Insert Control Number suffix.

1. GENERAL.

- 1.1 Scope. This specification covers hexahydrophthalic anhydride used as a curing agent for epoxy resins.
- 1.2 Definition. /M/ is a symbol placed adjacent to a section or paragraph to designate requirements or information pertinent only to Bendix KCD.

2. DOCUMENTS.

- 2.1 Required. The following document forms a part of this specification to the extent stated herein.

ASTM-D-1493	Solidification Point of Industrial Organic Chemicals.
-------------	---

3. REQUIREMENTS.

- 3.1 Properties. The material shall meet the following properties:

Property	Value	Test Method
-----	-----	-----
Solidification Point, Deg. C.	35 to 37	ASTM-D-1493

2TIE
DRC

3.1	Con't.		
	Property	Value	Test Method
	-----	-----	-----
	Acid Number.	715 to 735	4.3.1
	Purity, % min.	98	4.3.2
	Free Acid Content, % max.	1	4.3.2
3.2	Environment. Sample preparation and testing shall be performed at 18 to 30 Deg. C and 10 to 65 percent R.H.		

4. QUALITY ASSURANCE PROVISIONS.

- 4.1 Lot Definition. A lot shall be a homogeneous quantity of material.
- 4.2 Lot Inspection and Testing. A representative sample from each lot shall be inspected and tested for conformance with the requirements listed below:

Solidification Point.
Acid Number.
Purity.

4.3 Test and Inspection Methods.

- 4.3.1 Acid Number. Weigh approximately 0.3 gram of sample into a 250 ml erlenmeyer flask. Add 50 ml of acetone, reagent grade, and stir using a magnetic stirrer until the sample is completely dissolved. Add 10 ml of distilled water, a few drops of thymol blue indicator and titrate with 0.1 N sodium hydroxide to a blue color. Run a reagent blank and all samples in duplicate. Report average value.

Calculation:

$$\text{Acid No.} = \frac{(S-B) \times N \times 56.0}{W}$$

S = ml NaOH used in titrating sample.
B = NaOH used in titrating blank.
N = Normality of NaOH.
W = Sample weight in grams.

4.3.2 Purity Analysis and Free-acid Content.

- 4.3.2.1
- a. Melt sample at 40 Deg. C and agitate before proceeding. Weigh 1.1 to 1.3 grams of sample, to the nearest 0.0001 g, into a dry 250 mL stoppered Erlenmeyer flask.
 - b. Pipet 25.0 mL 0.2N morpholine solution into the flask, stopper, swirl to dissolve and let stand for 15 to 20 minutes.
 - c. While the sample is standing, run a blank as follows:
Pipette 25.0 mL 0.2N morpholine into a clean dry Erlenmeyer flask.
 - d. Add 74 to 75 mL isopropyl alcohol and 5 to 6 drops of thymophthalein.
 - e. Agitate rapidly and continuously with a magnetic stirrer and titrate slowly (one drop at a time) with 0.1N NaOH to the first blue color that persists at least 15 seconds. Do not overtitrate. Record the titrant volume to the nearest 0.5 mL (endpoint-1).
 - f. Immediately add 24 to 26 mL DI water, then 5 to 6 mL carbon disulfide and the instant the turbidity clears, titrate rapidly with NaOH, as fast as the blue color fades, until at endpoint a single drop produces a stronger blue color. The color should not fade completely in 15 seconds. Record total titrant volume to the nearest 0.05 mL (endpoint-2). The total titrant volume includes titrant volume at endpoint-1.
 - g. Titrate the sample from step b. as follows: Repeat steps d. and e. to obtain endpoint-3.
 - h. Immediately add 5 to 6 mL carbon disulfide and the instant turbidity clears add NaOH as rapidly as possible until the total mL NaOH in the flask is exactly the titrant volume at endpoint-2. If a blue color persists at least 30 seconds, endpoint-4 has been obtained and the titration is complete, otherwise, proceed to step i.
 - i. Continue the titration rapidly, in 0.1 mL increments, as fast as the blue color fades, until at the endpoint a single drop produces a stronger blue color that does not fade completely in 15 seconds. Record the total titrant volume to the nearest 0.05 mL (endpoint-4). The total titrant volume includes the titrant volume at endpoint-3.

4.3.2.2 Calculations: Report to nearest 0.1%.

a. Purity.

$$A = ((V \text{ sub } 3 - V \text{ sub } 1) - (V \text{ sub } 4 - V \text{ sub } 2))(N)(15.42)/(W)$$

4.3.2.2 Continued.

b. Free-acid content

$$B = (V \text{ sub } 4 - V \text{ sub } 2)(N)(8.61)/(W)$$

Where:

A = Purity, percent anhydride.

B = Free-acid content, percent.

N = Normality, of NaOH, milliequivalents per mL.

V sub 1 = Blank titrant volume at endpoint-1, mL.

V sub 2 = Blank titrant volume at endpoint-2, mL.

V sub 3 = Sample titrant volume at endpoint-3, mL.

V sub 4 = Sample titrant volume at endpoint-4, mL.

W = Sample weight, g.

5. /M/ PACKAGING, HANDLING AND STORAGE.

5.1 Package or Container Identification. Each individual container of material shall be marked with at least the following information:

Material Specification Number

Product Designation

Name of Material Producer

Material Producer's Lot Number

Date of Receipt

Storage Condition: C2-3

Shelf Life: 1 year from date of receipt

5.2 Safety and Material Damage Precautions. This material is hygroscopic. When containers are opened for testing or use, purge with dry nitrogen and reseal.

5.3 Shelf Life. The shelf life is one year from date of receipt. Any material that exceeds shelf life may be retested for purity and solidification point at 1 year intervals until all material is either consumed or scrapped.

6. NOTES.

6.1 Suggested Source.

Product Designation

Hexahydrophthalic Anhydride

Company

Buffalo Color Corp.
Buffalo, New York

END OF TEXT

10 MAY 1991

MSDS Id #: 3455

MATERIAL SAFETY DATA SHEET

Product Name: BKC 20121

Part #:

SECTION I SUPPLIER INFORMATION

Common Name : SYNONYMS: ~~EPICHLOROHYDRIN~~ BKC 62810 ADDUCT
Chemical Name : CHEMICAL NAME: CTEN RUBBER/EPOXY ADDUCT / CHEMICAL FAMILY:
EPICHLOROHYDRIN RESIN / FORMULA: NO DATA SUPPLIED
Formula/CAS : NOT ESTABLISHED

Hazard Tag Type : NO DATA SUPPLIED

Supplier : ALLIED-SIGNAL KCD Supplier #:8500
P.O. Box : P.O. BOX 419159
Address : 2000 EAST 95TH STREET
City, St, Zip: KANSAS CITY MO 64141-6159 Phone: 816-997-2474

***** EMERGENCY PHONE #: 816-997-3601 *****

Date Issued: 11-06-89

Date Entered: 07-16-90

Date Revised:

SECTION II INGREDIENT INFORMATION

4,4'-ISOPROPYLDENEDIPHENOL
NO DATA 90 CAS #: NO DATA PEL-OSHA: NOT ESTAB TLV-ACGIH: NOT ESTAB
EPICHLOROHYDRIN RESIN
NO DATA NO DA CAS #: NO DATA PEL-OSHA: NO DATA TLV-ACGIH: NO DATA
CARBOXYL TERMINATED BUTADIENE
NO DATA 10 CAS #: 68891-50-9 PEL-OSHA: NOT ESTAB TLV-ACGIH: NOT ESTAB
ACRYLONITRILE COPOLYMER
NO DATA NO DA CAS #: NO DATA PEL-OSHA: NO DATA TLV-ACGIH: NO DATA

***** INGREDIENT HAZARD STATEMENT *****

4,4'-ISOPROPYLDENEDIPHENOL: CAS #: NOT ESTABLISHED

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point : ABOVE 300 DEGREES C
Specific Gravity (H2O = 1): 1.15

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS continued on the next page.

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS continued from previous page.

Melting Point: NOT ESTABLISHED
Vapor Pressure (mm Hg): NIL
Vapor Density (Air=1): NOT ESTABLISHED
Evaporation Rate (Butyl Acetate=1): NIL
Material Density: NO DATA SUPPLIED
Solubility/Water: NIL

***** APPEARANCE AND ODOR *****

AMBER LIQUID WITH MILD ODOR.

***** ADDITIONAL INFORMATION *****

PERCENT VOLATILES BY VOLUME: NIL

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Flash Point: NOT ESTABLISHED
Auto-Ignition: NO DATA SUPPLIED
LEL: NOT ESTABLISHED
UEL: NOT ESTABLISHED

***** NFPA HAZARD CLASSIFICATION *****

Health: 1	Flammable: 1
Reactivity: 0	Special: NO DATA SUPPLIED

***** KCD HAZARD CLASSIFICATION *****

Health:	Flammable:
Reactivity:	Storage:

***** EXTINGUISHING MEDIA *****

WATER SPRAY, FOAM, CO2, DRY CHEMICALS.

***** SPECIAL FIRE FIGHTING PROCEDURES *****

IN REGIONS OF DENSE SMOKE, FIREFIGHTERS SHOULD WEAR SELF-CONTAINED BREATHING APPARATUS.

***** UNUSUAL FIRE AND EXPLOSION HAZARDS *****

NONE.

SECTION V REACTIVITY DATA

Stability? STABLE

SECTION V REACTIVITY DATA is continued on the next page.

SECTION V REACTIVITY DATA is continued from the previous page.

Avoid: STRONG OXIDIZING CONDITIONS.

***** INCOMPATIBILITY (Materials to Avoid) *****

STRONG OXIDIZERS.

***** HAZARDOUS DECOMPOSITION OR BY-PRODUCTS *****

CO2, CO, ALDEHYDES, TRACES OF HCN AND NOX

Polymerization? HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

Avoid: NONE KNOWN.

SECTION VI HEALTH HAZARD DATA

***** ROUTES OF ENTRY *****

Inhalation? YES

Skin? YES

Ingestion? YES

Eyes? NO DATA SUPPLIED

***** ADDITIONAL INFORMATION *****

PRIMARY ROUTES OF ENTRY: INHALATION, SKIN, INGESTION.

***** CARCINOGENICITY *****

NTP? NO

IARC? NO

OSHA? NO

NO DATA SUPPLIED

***** ACUTE AND CHRONIC HEALTH HAZARDS *****

PRIMARY SKIN IRRITATION ON PROLONGED CONTACT.

SIGNS AND SYMPTOMS OF EXPOSURE: SKIN IRRITATION.

***** SIGNS AND SYMPTOMS OF OVEREXPOSURE *****

HEALTH HAZARDS (ACUTE AND CHRONIC):

PRIMARY SKIN IRRITATION ON PROLONGED CONTACT.

SIGNS AND SYMPTOMS OF EXPOSURE: SKIN IRRITATION.

SECTION VI HEALTH HAZARD DATA is continued on the next page.

SECTION VI HEALTH HAZARD DATA is continued from the previous page.

***** MEDICAL CONDITIONS GENERALLY AGGRAVATED BY OVEREXPOSURE *****

NONE.

***** EMERGENCY AND FIRST AID PROCEDURES *****

REMOVE FROM SKIN WITH SOAP AND WATER OR WATERLESS SKIN CLEANER. FOR EYE CONTACT WASH WITH WATER FOR 15 MINUTES.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

DOT Classification: NOT APPLICABLE

***** STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED *****

MINIMIZE SPILL AREA. APPLY SALT OR SWEEPING COMPOUND TO MAKE IT LESS STICKY AND EASIER TO CLEAN UP. SCOOP UP.

***** WASTE DISPOSAL METHOD *****

DISPOSE IN COMPLIANCE WITH LOCAL, STATE, AND FEDERAL ENVIRONMENTAL REGULATIONS.

***** PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE *****

USE APPROPRIATE PROTECTIVE EQUIPMENT TO PREVENT DIRECT CONTACT. AN EYEWASH/SAFETY SHOWER SHOULD BE AVAILABLE IN THE AREA. GOOD WAREHOUSING PROCEDURE.

***** OTHER PRECAUTIONS *****

TRANSPORTATION: (DOT): NOT APPLICABLE.

SECTION VIII CONTROL MEASURES

***** RESPIRATORY PROTECTION *****

NOT CONSIDERED NECESSARY.

***** VENTILATION *****

Local Exhaust: RECOMMENDED
Special Exhaust: 100 FT./MIN. RECOMMENDED.
Mechanical Exhaust: (GENERAL): RECOMMENDED

SECTION VIII CONTROL MEASURES is continued on the next page.

SECTION VIII CONTROL MEASURES is continued from the previous page.

***** OTHER PROTECTION *****
NOT ESTABLISHED

Gloves: IMPERVIOUS TO INGREDIENTS.
Eye Protection: CHEMICAL GOGGLES/FACE SHIELD.

***** CLOTHING *****
NECESSARY TO PREVENT SKIN CONTACT.

***** WORK/HYGIENE PRACTICES *****
STANDARD FOR DEALING WITH CHEMICALS.

**** SARA HAZARD CATEGORIES ****

FIRE HAZARD	_____	SUDDEN RELEASE OF PRESSURE	_____
IMMEDIATE (ACUTE) HEALTH HAZARD	_____	DELAYED (CHRONIC) HEALTH HAZARD	_____
REACTIVITY HAZARD	_____		

Conversion Value to Pounds :
Chemical Descriptor: MIXTURE LIQUID
RQ (Reportable Quantity): NO DATA SUPPLIED

THIS IS THE END OF THE MSDS Id #3455
Page 5

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END

**DATE
FILMED**

12/03/93