



Engineered Polymers, Inc.



2842 Progress Road • Madison, WI 53716 • (608) 661-2800

Effective Date: 10/21/2003

Material Safety Data Sheet

MAP A-Side

In case of emergency call CHEMTREC 1-800-424-9300

Product Name: **MAP Modified Aliphatic Prepolymers[®]**
Chemical family: Aliphatic Polyisocyanate
Chemical Name: 1,6-Hexamethylene Diisocyanate Based Polyisocyanate

1. Composition! Information on Ingredients:

Homopolymer of HDI	28182-81-2	
OSHA:	Not established	essentially 100%
ACGIH:	Not established	

The recommended Manufacturer Guideline Level (MGL) for HDI based polyisocyanates is 0.5mg/m³ (TWA-averaged over 8 hours) and 0.1mg/m³ Short Term Exposure (STEL-averaged over 15 minutes)

Hexamethylene Diisocyanate (Hf I) 822-06-0

OSHA:	Not established	*%
ACGIH:	.005 ppm TWA	

*Monomer content is less than 0.2% based on resin solids at the time of manufacture. We also recommend a ceiling level of 0.02ppm (Manufacturer Guideline Level).

2. Hazards

Identification:
Emergency
Overview

Warning! Color: Clear/Pale Yellow; Form: Liquid; Odor: Negligible; May Cause lung damage; May cause eye, skin, and respiratory tract irritation; May cause allergic respiratory reaction; Harmful if inhaled; May cause allergic skin reaction; Closed container may explode under extreme heat or when contaminated with water; Toxic gases/fumes are given off during burning or thermal decomposition.

Potential Health Effects:

Route of Entry: Inhalation, skin contact, eye contact

Acute Inhalation: HDI vapors or mists at concentrations above the TLV or MGL can irritate (burning sensation) the mucous membranes in the respiratory tract (nose, throat, lungs) causing runny nose, sore throat, coughing, chest discomfort, shortness of breath, and reduced lung function (breathing obstruction). Persons with a preexisting, nonspecific bronchial hyper reactivity can respond to concentrations below the TLV or MGL with similar as well as an asthma attack. Exposure well above the TLV or MGL may lead to bronchitis, bronchial spasm, and pulmonary edema (fluid in lungs). These effects are usually reversible. Chemical or hypersensitive pneumonitis, with flu-like symptoms (e.g. fever, chills) has also been reported.



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Chronic Inhalation: because of previous repeated overexposures or a single large dose, certain individuals will develop isocyanate sensitization (chemical asthma), which will cause them to react to a later exposure to isocyanate at levels well below the TLV or MGL. These symptoms, which include chest tightness, wheezing, cough, shortness of breath or asthma attack, could be immediate or delayed up to several hours after exposure. Similar to many nonspecific asthmatic responses, there are reports that once sensitized an individual can experience these symptoms upon exposure to dust, cold air, or other irritants. This increased lung sensitivity can persist for weeks and in several years. Chronic overexposure to isocyanates has been reported to cause lung damage, including decrease in lung function, which may be permanent. Sensitization may be either temporary or permanent.

Acute skin Contact: Isocyanates react with the skin protein and moisture and can cause irritation. Symptoms of skin irritation may be reddening, swelling, rash, scaling, or blistering. Some persons may develop skin sensitization from skin contact. Cured material is difficult to remove.

Chronic Skin contact: Prolonged contact with the isocyanate can cause reddening, swelling, rash, scaling, or blistering. In those who have developed a skin sensitization, these symptoms can develop because of contact with very small amounts of liquid material or even because of vapor-only exposure.

Acute Eye Contact: Liquid, aerosols, and vapors of this product are irritating and can cause pain, tearing, reddening, and swelling accompanied by a stinging sensation and/or a feeling like that of fine dust in the eyes.

Chronic Eye Contact: May result in corneal (clouding of the eye surface).

Acute Ingestion: Can result in irritation and possible corrosive action in the mouth, stomach tissue and digestive tract.

Chronic Ingestion: None found

Carcinogenicity: NTP- not listed IRAC- not listed OSHA-not regulated

Medical Conditions Aggravated By Exposure: Asthma and other respiratory disorders (bronchitis, emphysema, and hyper reactivity), skin allergies, eczema.

Exposure Limits: Not established for product as a whole. Refer to Section II for exposure limits of hazardous constituents. The manufacturer Guideline Level of 0.5 mg/m³- TWA and 1.0 mg/m³-STEL for the Homopolymer of HDI and 0.02 ppm ceiling for HDI monomer are internal guides based on limited data: they are provided as guides pending the review of future data.



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3. First Aid Measures:

Eyes: Flush with clean, lukewarm water (low pressure) for at least 15 minutes, while lifting eyelids. Refer individual to physician or ophthalmologist for immediate follow-up.

Skin: Remove contaminated clothing immediately. Wash affected areas thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse. For severe exposure, get under safety shower after removing clothing, and then get medical attention. For lesser exposures, seek medical attention if irritation develops or persists.

Inhalation: Move to an area free from risk of further exposure. Administer oxygen or artificial respiration as needed. Obtain medical attention. Asthmatic-type symptoms may develop and may be immediate or delayed up to several hours. Treatment is essentially symptomatic. Consult physician.

Ingestion: DO NOT INDUCE VOMITING! Give 1 to 2 cups of milk or water to drink. DO NOT GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR CONVULSING PERSON. Consult physician.

NOTE TO PHYSICIAN: Eyes- stain for evidence of corneal injury. If cornea is burned, instill antibiotic/steroid preparation frequently. Workplace vapors could produce reversible corneal epithelial edema impairing vision. Skin: this product is a known skin sensitizer. Treat symptomatically as for contact dermatitis or thermal burn. Ingestion: treat symptomatically. There is no specific antidote. Inducing vomiting is contraindicated because of the irritating nature of the product. Inhalation- This product is a known pulmonary sensitizer. Treatment is essentially symptomatic. An individual having dermal or pulmonary sensitization reaction to this material must be removed from any further exposure to any isocyanate.

4. Fire Fighting Measures:

Flash Point: Greater than 2000F (93oC)
Extinguishing Media: Dry chemical, foam, carbon dioxide, and water spray for large fires. Special fire fighting procedures: Full emergency equipment with self-contained breathing apparatus and full protective clothing should be worn by firefighters. During a fire, HDI vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion (See Section 10). Closed container may explode when exposed to extreme heat or burst when contaminated with water (CO₂ evolved).

5. Accidental Release Measures:

Spill or leak procedures: Evacuate nonessential personnel. Remove all sources of ignition and ventilate the area. Notify appropriate authorities if necessary. Put on personnel protective equipment (see Section 7). Dike or impound spilled material and control further spillage if feasible. Use vermiculite, Fuller's earth or other absorbent material. Pour decontamination solution over spill area and allow to react for at least 10 minutes. Collect material in open containers and add further



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amounts of decontamination solution. Remove containers to a safe place, cover loosely, and allow to stand for 24 to 48 hours. Wash down spill area with decontamination solutions. Decontamination solutions: nonionic surfactant Union Carbide's Tergitol TMN-IO (20%) and water (80%); concentrated ammonia (3-8%), detergent (2%) and water (90-95%).

6. Handling and Storage:

Storage Temperature (mm/max):

-30F (-34C)!122 F (50C)

Shelf Life:

6 months at 77F (25C) after receipt

of material by customer.

Special Sensitivity:

If container is exposed to high heat, it can be pressurized and possibly rupture explosively. Nfl reacts slowly with water to form CO2 gas. This gas can cause sealed containers to expand and rupture explosively. Handling and Storage Precautions: Store in tightly closed. containers to prevent moisture contamination. Do not reseal if contamination is suspected. At maximum storage temperatures noted, material may slowly polymerize without hazard. Ideal storage temperature range for ease of handling is 50-81F (10-27C). Avoid contact with skin and eyes. Employee education and training in the safe use and handling of this product are required under the OSHA Hazard Communication Standard.

7. Personal Protection:

Required work/hygiene procedures: Precautions must be taken so that persons handling this product do not allow contact with the eyes or skin. In spray operations, protection must be afforded against exposure to both vapor and spray mist.

Skin Protection Requirements: Permeation resistant gloves. Cover as much of the exposed skin area as possible with appropriate clothing. If skin cream is used, keep the area protected only by the cream to a minimum.

Ventilation Requirements: Good industrial hygiene practice dictates that worker protection should be achieved through engineering controls such as ventilation; the use of respirators and other personal protective equipment is mandated. (See respirator requirements) Exhaust air may need to be cleaned by scrubbers or filters to reduce environmental contamination. Curing ovens must be ventilated to prevent emissions into the workplace. Of oven off-glass are not vented properly (i.e. They are released into the work area), it is possible to be exposed to airborne monomeric HDI.

Respirator Requirements: A respirator that is recommended or approved for use in isocyanate containing environments (air purifying or fresh air supplied) may be necessary for spray applications or other situations such as high temperature use, which may produce inhalation exposures. A supplied air respirator (either positive pressure or continuous flow type) is recommended. Before an air-purifying respirator can be used, air monitoring must be performed to measure airborne concentrations of HDI monomer, HDI polyisocyanate and organic solvent(s). See the outline below for the specific conditions under which air-purifying respirators can be used. Observe OSHA regulations for respirator use (29 CFR 1910.134).



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Spray Applications:

A. Good industrial hygiene practice dictates that when isocyanate based coatings are sprayed

applied, some form of respiratory protection should be worn. During the spray application of organic solvent containing coatings systems, the use of a supplied-air (either positive pressure or continuous flow type) respirator is mandatory when ONE or MORE of the following conditions exists:

- the airborne isocyanate concentrations are not known; or
- the airborne isocyanate monomer concentrations exceed 0.05 ppm (10 times the TLV); or
- the airborne polyisocyanate (polymeric, oligomeric) concentrations exceed 5 mg/m³ averaged over 8 hours or 10 mg/m³ averaged over 15 minutes (10 times the MGL) ;or no airborne solvent concentration exceeds its odor threshold; or
- spraying is performed in a confined space (see OSHA Confined Space Standard 29 CFR 1910.146).

A properly fitted air-purifying (combination organic vapor and particulate) respirator, proven by test to be effective in isocyanate-containing spray paint environments, and used in accordance with all recommendations made by the manufacturer, can be used when all of the following conditions are met:

- the airborne isocyanate monomer concentrations are known to be below 0.05 ppm (10 times the TLV); and
- the airborne polyisocyanate (polymeric, oligomeric) concentrations are known to be below 5 mg/m³ averaged over 8 hours or 10 mg/m³ averaged over 15 minutes (10 times the MGL); and
- at least one solvent has a published odor threshold*; and
- at least one airborne solvent concentration exceeds its odor threshold and that solvent's odor threshold is lower than its TLV.

B. During the spray application of a coating system NOT containing organic solvents a supplied-air (either positive or continuous flow type) respirator is mandatory when ONE or MORE of the following conditions exist:

- the airborne isocyanate concentrations are not known; or
- the airborne isocyanate monomer concentration exceeds the MGL of 0.5 ppm; or
- the airborne polyisocyanate (polymeric, oligomeric) concentration exceeds the MGL of 0.5 mg/m³ averaged over 8 hours or 1 mg/m³ averaged over 15 minutes; or
- spraying is performed in a confined space (See OSHA Confined Space Standard 29 CFR



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1910.146).

Under any other circumstances, during a spray application of a coatings system NOT containing organic solvents, good industrial hygiene practice dictates that when isocyanate based coatings

are spray applied at least an air-purifying respirator should be worn.

Non-spray Operations:

A. During non-spray operations such as mixing, batch mixing, brush or roller application, etc., at elevated temperatures (for example, heating of material or application to a hot substrate), it is possible to be exposed to airborne isocyanate vapors. Therefore, when the coatings system contains solvents and will be applied in a non-spray manner, a supplied-air (either positive pressure or continuous flow type) respirator is mandatory when ONE or MORE of the following conditions exists:

- the airborne isocyanate concentrations are known, or
- the airborne isocyanate monomer concentrations exceed 0.05 ppm (10 times the TLV); or
- the polyisocyanate (polymeric, oligomeric) concentrations exceed 5 mg/m³ averaged over 8 hours or 10 mg/m³ averaged over 15 minutes (10 times the MGL); or
- no airborne solvent concentrations exceeds its odor threshold; or
- operations are performed in a confined space (see OSHA Confined Space Standard 29 CFR 1910.146).

B. A properly fitted air-purifying (combination organic vapor and particulate) respirator, proven by test to be effective in isocyanate-containing paint environments, and used in accordance with all recommendations made by the manufacturer, can be used when ALL of the following conditions are met:

- the airborne isocyanate monomer concentrations are known to be below 0.05 ppm (10 times the TLV); and
- the airborne polyisocyanate (polymeric, oligomeric) concentrations are known to be below 5 mg/m³ averaged over 8 hours or 10 mg/m³ averaged over 15 minutes (10 times the MGL); and
- at least one solvent has a published odor threshold*; and
- at least one airborne solvent concentration exceeds its odor threshold and that solvent's odor threshold is lower than its TLV.

C. During non-spray operations using a solvent-free a supplied-air (either positive pressure or continuous flow type) respirator is mandatory when ONE or MORE of the following conditions exist:

- the airborne isocyanate concentrations are not known; or
- the airborne isocyanate monomer concentration exceeds the TLV of 0.005 ppm; or
- the airborne polyisocyanate (polymeric, oligomeric) concentration exceeds the MGL of 0.5mg/m³ averaged over 8 hours or 1mg/m³ averaged over 15 minutes; or
- operations are performed in a confined space (See OSHA Confined Space Standard



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Monitoring:

Refer to Patty's Industrial Hygiene and Toxicology-Volume I (3rd edition) Chapter 17 and Volume III (first edition) Chapter 3-for guidance concerning appropriate air sampling strategy to determine airborne concentrations of isocyanates and solvent.

Medical Surveillance

Medical supervision of all employees who handle or come in contact with this product is recommended. This should include pre-employment and periodic medical examinations with respiratory function tests (FEV, FVC as a minimum). Persons with asthma-type conditions, chronic bronchitis, other chronic respiratory diseases or recurrent skin eczema or sensitization should be excluded from working with isocyanates. Once a person is diagnosed as sensitized to an isocyanate, no further exposure can be permitted.

Additional Protective Measures:

Safety showers and eyewash stations should be available. Educate and train employees in safe use of product. Follow all label instructions.

- We recommend using the Geometric Mean Air Odor Threshold found in Table 5.1 of "Odor Thresholds for Chemicals with established Occupational Health Standards" - AIHA

8. PHYSICAL AND CHEMICAL PROPERTIES:

Physical Form: Liquid
Color: Clear/Pale Yellow
Odor: Negligible

Molecular Weight: Approx. 500 (polyisocyanate) Boiling Point: 382F (194C)

Solubility in Water: Resin is insoluble-reacts slowly with water to liberate CO₂ gas

Bulk Density: 9.25 lb./gal % Volatile by Weight: Negligible Vapor Pressure:

Polyisocyanate: Approx. 7.5 x 10⁻⁵ mmHg @ 20C

9. STABILITY AND REACTIVITY:

Stability: Stable under normal conditions

Hazardous Polymerization: May occur; contact with moisture or other materials, which react with isocyanates or temperatures above 400F (204C) may cause polymerization.

Incompatibilities: Water, amines, strong bases, alcohols, metal compounds and surface-active materials



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Instability Conditions: None Known

Decomposition Products: By high heat and fire: carbon dioxide, carbon monoxide, and oxides of nitrogen, HCN, HDI.

10. Toxicological Information:

Toxicity Data for HDI homopolymer materials except where indicated

Acute Toxicity:

Oral LD50: Estimated to be greater than 10000mg/kg (rats). (Based on results of actual tests conducted using specific HDI homopolymer products)

Dermal LD50: Estimated to be greater than 5000 mg/kg (rabbits) (based on the results of actual tests conducted using specific HDI homopolymer products.)

Inhalation LC50: Lower respiratory (pulmonary) irritant. LC50 values range from 137-1150 mg/m³ were obtained in rats exposed to aerosols. (4H exp.)

Eye Effects: Severe irritant capable of inducing corneal injury (rabbit); maximum primary eye irritation score: 54.6/110 for a 24-hour exposure.

Skin Effects: Moderate irritant; primary dermal irritation score:3.4/8.0 (rabbit)

Sensitization: Pulmonary and dermal sensitizer in humans. Delayed dermal sensitization was observed in guinea pigs. However, the respiratory sensitization potential of Desmodur N-3300 assessed in guinea pigs was negative. Evidence exists that cross-sensitization between HDI and other isocyanates, particularly hydrogenated MDI and TDI, can occur.

Other Acute Effects: Ames test: Negative for Desmodur N-100 (100% solids material).

Subchronic Toxicity: Rats exposed to a HDI homopolymer (isocyanate type, specifically, the solvent-free Desmodur N-3300), at aerosol concentrations of 4.3, 14.7 and 89.8 mg/m³ for three weeks (6 hr./day, 5 days/wk) exhibited respiratory distress and inflammation of the nasal passages at 14.7 mg/m³ and above. At the 89.8 mg/m³ level, inflammatory lesions at many sites of the lungs were also observed. The No Observable Effect Level (NOEL) was 4.3 mg/m³. Rats were also exposed to an HDI homopolymer (isocyanate type, specifically, the solvent-free Demodur N-3300), for 13 weeks (6hr./day, 5 days/wk) at aerosol concentrations of 0.5,3.3 and 26.4 mg/m³. Body weight gains of male rats of the 26.4-mg/m³ group were slightly reduced toward the end of the study. The lung weight to body weight ratio was significantly increased in the male and female rats of the 26.4 mg/m³ group. Histopathologic diagnosis of these animals revealed inflammatory changes and formation of fibrous tissue at the point of injury in the respiratory tract. In addition, the lung function tests at the end of the study provided evidence of a chronic obstructive disorder in rats of the 26.4 mg/m³ group. The No Observable Effect Level (NOEL) in this study is considered to be 3.3 mg/m³.

Other Toxicity Data: Mice were exposed to a liquid aerosol of an HDI homopolymer (isocyanurate type, specifically, the solvent-free Desmodur N-3300), mixed with acetone for



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three hours. The irritation potential expressed as the RD50 (the concentration which is

predicted to reduce the respiratory rate 50%) was 20.8 mg/m³ (95% confidence interval= 18.3 to 23.9 mg/m³). Pulmonary (lung) irritation was observed first, following by sensory (eye, nose, and throat) irritation.

11. Disposal Considerations:

Waste Disposal Method: Waste must be disposed of in accordance with federal, state, and local environmental control regulations. Incineration is the preferred method. DO NOT HEAT OR CUT EMPTY CONTAINER WITH ELECTRIC OR GAS TORCH.

12. Transportation Information:

Technical Shipping Name: Polyisocyanate
Freight Class Bulk: Isocyanate
Freight Class Package: Chemicals, NOI (isocyanate~), NMFC 60000
DOT (*Domestic* Surface) -Hazard Class or Division: Non-regulated

IMO/IMDG Code (ocean)-Hazard Class Division Number: Non-regulated ICAO/IATA (Air)

-Hazard Class Division Number: Non-regulated

13. Regulatory Information:

OSHA Status: This product is hazardous under the criteria of Federal OSHA .

Hazard Communication Standard 29 CFR 1910.1200.

TSCA Status: On TSCA inventory CERCLA Reportable Quantity: None

SARA Title III:

Section 302 Extremely Hazardous Substances: None

Section 311/312 Hazard Categories: Immediate Health Hazard; Delayed Health Hazard;
Reactive hazard

RCRA Status: If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as hazardous waste. (40 CFR 261.20-24)

The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements.



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For details on your regulatory requirements, you should contact the appropriate agency in your state.

Homopolymer of Nfl

CAS # 28182-81-2 Concentration: Essentially 100% State Code: PA3, NJ4

NJ4=New Jersey Other- included in 5 predominant ingredients> 1% PA3= Pennsylvania Non-hazardous present at 3% or greater

California Proposition 65

To the best of our knowledge, this product contains no levels of listed substances, which the state of California has found to cause cancer, birth defects or other reproductive effects.

Massachusetts Substance List (MSL)

Hazardous Substances and Extraordinarily Hazardous Substances on the MSL must be identified when present in products. To the best of our knowledge, this product contains no substances at a level, which could require reporting under the statute.

14. Other Information:

HMIS Ratings:	Health	Flammability	Reactivity
	2*	1	1

0=Minimal 1=Slight 2=Moderate 3=Serious

4=Severe *chronic health hazard