Product Safety Assessment

**DOW™ Modified Isophorone Diisocyanate (IPDI) Products**


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**Names**

- CAS No. 4098-71-9 (IPDI)
- Isophorone diisocyanate
- 3-Isocyanatomethyl-3,5,5-trimethylcyclohexyl isocyanate
- IPDI
- IPDI prepolymer
- CAS 67423-04-5
- Oxirane, 2-methyl-, polymer with oxirane, ether with 2-ethyl-2-(hydroxymethyl)-1,3-propanediol (3:1), polymer with 5-isocyanato-1-(isocyanatomethyl)-1,3,3-trimethylcyclohexane

Trade names for DOW™ modified isophorone diisocyanate products include, but are not limited to:

- HYPOL™ G-50 Prepolymer
- TRAFFIDECK™ Topcoat UV40(S)

**Product Overview**

- **DOW™** modified isophorone diisocyanate (IPDI) products are clear-to-brown colored, liquid products formed by reacting isophorone diisocyanate with hydroxyl-containing materials (e.g., polyols).\(^1\)\(^2\) For further details, see Product Description.
- HYPOL™ G-50 Prepolymer is used in industrial applications and designed to provide hydrophilic (water-attracting) properties within the polymer backbone. TRAFFIDECK™ Topcoat UV40(S) forms a continuous, flexible membrane to waterproof and protect parking-lot decks, roofs, bridges and walkways, plaza decks, and balconies.\(^3\)\(^4\) For further details, see Product Uses.
- Dow does not sell modified IPDI products for direct consumer use, but they are used in the production of consumer goods. There is a potential for workplace exposure to modified IPDI products in all industrial, commercial, or manufacturing settings where modified IPDI products are present. Each manufacturing facility should have a thorough training program for employees, appropriate work processes and safety equipment in place to limit exposure. Workers applying these materials can minimize the potential for exposure by carefully following application directions and wearing the proper safety equipment. For further details, see Exposure Potential.
- Eye contact with these materials may cause severe irritation or corneal injury. Vapor may cause eye irritation. Prolonged skin contact may cause moderate irritation with local redness. Repeated skin contact with DOW™ modified isophorone diisocyanate products containing xylene may

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cause burns. Inhalation exposure may cause respiratory irritation and central nervous system depression. Excessive inhalation exposure may cause severe irritation or injury to upper respiratory tract (nose and throat) and lungs. Isophorone diisocyanate may cause allergic skin and respiratory responses. Once sensitized, re-exposure to very small amounts may trigger an allergic reaction.\textsuperscript{5,6} For further details, see Health Information.

- The movement of residual isophorone diisocyanate in the environment is limited by its reaction with water to form insoluble polyureas, which are stable in soil and water environments. Isophorone diisocyanate and its hydrolyzed products are unlikely to accumulate in the food chain, and are moderately toxic to aquatic organisms.\textsuperscript{7,8} Xylene, a flammable solvent in some DOW modified isophorone diisocyanate products, is biodegradable, unlikely to accumulate in the food chain, and is toxic to aquatic organisms. For further details, see Environmental Information.

- DOW modified isophorone diisocyanate products are stable at recommended storage and use temperatures. However, exposure to elevated temperatures can cause the products to decompose. Generation of gas during decomposition can cause rapid pressure build-up in closed systems. Isophorone diisocyanate reacts slowly with water, releasing carbon dioxide, which can cause pressure build-up and rupture of closed containers. Elevated temperatures can accelerate this reaction. Reaction with water will generate heat. Avoid contact with water (moisture), acids, alcohols, amine, ammonia, bases, metal compounds, strong oxidizers, or moist organic absorbents. Avoid contact with metals such as zinc, brass, tin, or galvanized metals. These products can react with themselves at temperatures above 130°C (266°F). This polymerization is catalyzed by strong bases or water. DOW \textsuperscript{TM} modified isophorone diisocyanate products that contain xylene are flammable.\textsuperscript{9,10} No smoking, open flames, or sources of ignition should be permitted in handling and storage areas. Electrically bond and ground all containers and equipment before transfer or use. For further details, see Physical Hazard Information.

- FOR EMERGENCY RESPONSE INSIDE THE UNITED STATES: Call CHEMTREC (1-800-424-9300) for advice on spilled IPDI, fire, or other handling issues. Modified IPDI products react with water to produce heat and carbon dioxide (CO\textsubscript{2}) gas. For further details, see Physical Hazard Information.

### Manufacture of Product

- **Locations** – DOW\textsuperscript{TM} modified isophorone diisocyanate products are marketed by Dow Formulated Systems and Dow Hyperlast. These Dow business units operate a global network of 26 system houses.

- **Process** – Modified IPDI-based prepolymers and variants are produced by a carefully controlled reaction between isophorone diisocyanate and hydroxyl-containing materials as shown below.

\[\text{IPDI} + \text{OH-R-CH} \rightarrow \text{Prepolymer}\]

\[\text{Prepolymer} \rightarrow \text{Polyurethane}\]

\[\text{Polyurethane} \rightarrow \text{Dow Formulated Systems} \text{ or Dow Hyperlast products}\]

\[\text{Polyurethane} \rightarrow \text{Elastomers}\]

\[\text{Elastomers} \rightarrow \text{Dow Formulated Systems} \text{ or Dow Hyperlast products}\]

\[\text{Dow Formulated Systems} \text{ or Dow Hyperlast products} \rightarrow \text{End Use Applications}\]
Product Description \textsuperscript{11,12}

DOW™ modified isophorone diisocyanate products are liquids that range in color from clear to brown depending on the formulation. These products are industrial chemicals and are customized or designed for specific applications. DOW isophorone diisocyanate products may contain some free or unreacted isophorone diisocyanate, as well as other additives (e.g., xylene in some formulations). Dow markets these products under different trade names for different end-use applications. Dow trade names for these products and variants include, but are not limited to HYPOL™ G-50 Prepolymer and TRAFFIDECK™ Topcoat UV-40(S).

Product Uses \textsuperscript{13,14}

DOW™ modified IPDI products are used to produce polyurethanes for the following applications:

- **HYPOL™ G-50 Prepolymer** – hydrophilic gels. For more information, please contact the Dow Customer Information Group.
- **TRAFFIDECK™ Topcoat UV40(S)** – continuous, flexible membrane for waterproofing and surfacing systems for parking decks, roofs and balconies, bridges. The cured membrane is resistant to automotive fluids, salts and dilute acids.

Exposure Potential \textsuperscript{15,16}

DOW™ modified isophorone diisocyanate products are used in the production of industrial and consumer products. Dow does not sell modified IPDI products for direct consumer use, but they are used as raw materials to make products that may reach consumers. There is a potential for workplace exposure to modified IPDI products in all industrial, commercial, or manufacturing settings where modified IPDI products are present. Those planning to work with, handle, or use them should review the relevant Safety Data Sheet and follow the precautions. Based on these uses, persons could be exposed to these products through:

- **Workplace exposure** – Exposure can occur either in a manufacturing facility or in the various industrial or commercial facilities that use these products. DOW modified isophorone diisocyanate products are produced, distributed, and stored in closed systems. Those working with these materials in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Carefully following application directions and wearing the proper safety equipment will minimize the potential for exposure. Each facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit exposure. See Health Information.
- **Consumer exposure to products containing isophorone diisocyanate** – Modified IPDI products manufactured by Dow Formulated Systems and Dow Hyperlast are intended for industrial use only. Consumers may purchase goods that have been manufactured with modified IPDI products; however, by the time these goods reach the consumer, the polyurethane has fully cured (hardened) and risk of exposure to unreacted IPDI and xylene is very low. See Health Information.
- **Environmental releases** – Environmental emissions of DOW modified IPDI products are unlikely to result from their manufacture and/or intended use, as contact of these products with air, water, or soil results in reactions which degrade product purity and performance. Modified isophorone diisocyanate prepolymers will react with water forming insoluble polyureas. Prepolymers released to soil are expected to similarly react with water present, and due to the high molecular weight, these insoluble solids are resistant to biodegradation and hydrolysis, and have very low potential for introduction to and transport within groundwater. Xylene, present as a solvent in some prepolymer formulations, will readily evaporate from water or soil if spilled, and any portion remaining in soil or water is expected to be rapidly biodegraded. In the event of a spill, the focus
is on containing the spill to prevent contamination of soil and surface or ground water. Spills or leaks of modified IPDI products should be contained and cleaned up only by properly trained and equipped personnel – all others should leave the contaminated area. Respiratory protection is necessary for cleaning up spills and leaks. Eliminate all sources of ignition immediately. For small spills, these products should be absorbed with materials such as sawdust, wet soil, vermiculite, sand, or clay. Do not use absorbent materials such as cement powder as this may generate heat. Collect absorbed material in suitable and properly labeled open containers. Do not place in sealed containers. Wash the spill site with large quantities of water. Attempt to neutralize by adding suitable decontaminant solution. See the relevant Safety Data Sheet for decontaminant solution formulas. See Environmental, Health, and Physical Hazard Information.

**Release or Spill** – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, the material should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. Eliminate all sources of ignition immediately. Local emergency crews and trained personnel should be called to handle large spills. Only properly trained and equipped personnel should attempt to isolate or contain the spill. Positive-pressure, self-contained breathing apparatus (SCBA) with an approved full-face mask is recommended for all emergency work. For xylene-containing products, use only explosion-proof pumps and other equipment; ground and bond all containers and handling equipment. Smother or suppress vapors with foam. See Environmental, Health, and Physical Hazard Information.

**In case of fire** – Deny any unnecessary entry into the area. Use water spray or fog, carbon-dioxide or dry-chemical extinguishers, or foam to extinguish the fire. General-purpose or protein-based foams are preferred for xylene-containing formulations. Alcohol-resistant foams (ATC type) are the best choice for HYPOL™ G-50 Prepolymer. Do not use a direct water stream, as it may spread the fire. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Fight the fire from a protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sounds from venting safety devices or discolorations of the container. Follow emergency procedures carefully. Contain fire-water run-off if possible, as it could cause environmental damage. See Environmental, Health, and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group or through the appropriate Polyurethanes Regional Call Center.

**Health Information**

Health information associated with individual DOW™ modified isophorone diisocyanate products may vary by formulation and application. The Safety Data Sheet is the preferred source for specific information. DOW™ modified isophorone diisocyanate products are industrial chemicals and are customized or designed for specific applications. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. These products may contain some free or unreacted isophorone diisocyanate, as well as other additives. An overview of health information for IPDI products appears below.

**Eye contact** – Eye contact with these products may cause severe eye irritation and moderate corneal injury. Vapor may cause eye irritation experienced as mild discomfort and redness.

**Skin contact** – Prolonged skin contact with these materials may cause moderate skin irritation with local redness but is unlikely to result in absorption of harmful amounts. Repeated contact with xylene-containing formulations may cause skin burns. Symptoms may include pain, severe local redness, swelling, and tissue damage. Vapor may cause skin irritation or drying and flaking of the skin.

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**Inhalation** – Excessive exposure to isophorone diisocyanate products may cause severe irritation or injury to upper respiratory tract (nose and throat) and lungs. In addition, for xylene-containing formulations: vapor concentrations are attainable that could be hazardous on single exposure. Excessive inhalation may cause respiratory irritation and central nervous system depression with headache, dizziness, and drowsiness, progressing to lack of coordination and unconsciousness.

**Ingestion** – These products have low toxicity if swallowed. However, swallowing large amounts may cause injury. Swallowing may result in gastrointestinal irritation or ulceration. Aspiration into the lungs may occur during ingestion or vomiting, causing lung damage or even death due to chemical pneumonia.

**Sensitization** – Isophorone diisocyanate may cause allergic skin and respiratory responses in humans. Once an individual is sensitized, re-exposure to very small amounts of vapor, mist, or liquid isophorone diisocyanate may cause allergic reaction.

**Other** – Exaggerated doses of xylene given orally to pregnant mice resulted in an increase in cleft palate, a common developmental abnormality in mice. In animal inhalation studies, xylene caused toxicity to the fetus, but not birth defects. Genetic toxicity studies have been negative.

For more information, request the relevant Safety Data Sheet from the [Dow Customer Information Group](#) or through the [Polyurethanes Regional Call Center](#).

**Environmental Information**¹⁹,²⁰

Environmental information associated with individual DOW™ modified isophorone diisocyanate products may vary by formulation and application. The Safety Data Sheet is the preferred source for specific information. DOW modified isophorone diisocyanate products may contain some free or unreacted isophorone diisocyanate, as well as other additives.

Spilled modified IPDI-based products should be prevented from entering soil, ditches, sewers, waterways, and/or groundwater. IPDI-based prepolymer products are insoluble in water. Upon contact with water or moist air, these products will react to form stable, insoluble polyurea solids. This reactivity dramatically limits the mobility of these products in the event of a spill (spills are localized and have only transient impact), and the products will tend to remain in, and react within, the environment to which they are released.

The polyurea solids formed by reaction of IPDI-based polymer products with water are not readily biodegradable, and are resistant to further hydrolysis. However, they will not accumulate in the food chain due to their high molecular weight. Once the reaction of IPDI-based prepolymer product with water is complete, the resulting polyureas are regarded as “inert” in the environment. IPDI-based polymer products, along with their associated products of reaction with water, have been tested in a number of aquatic species with overall findings ranging from “toxic” to “practically non-toxic” depending upon the test conditions and species employed.

Environment Canada has concluded that IPDI did not meet its criteria for classification as persistent, bioaccumulative, or inherently toxic to aquatic organisms; and therefore the substance was not identified as a priority for further assessment under its Categorization and Screening of the Domestic Substances List (CSDSL) program.²¹

Xylene, a solvent used in some isophorone diisocyanate prepolymer formulations, is readily biodegradable, unlikely to accumulate in the food chain, and is “toxic” to aquatic organisms.

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Physical Hazard Information

Physical hazard information associated with individual DOW™ modified isophorone diisocyanate products may vary by formulation and application. The Safety Data Sheet is the preferred source for specific physical hazard information. DOW™ isophorone diisocyanate products may contain some free or unreacted IPDI, as well as other additives.

These products are stable at recommended storage and use temperatures. However, exposure to elevated temperatures can cause the product to decompose. Generation of gas during decomposition can cause rapid pressure build-up in closed systems. Isophorone diisocyanate reacts slowly with water, releasing carbon dioxide, which can cause pressure build-up and rupture of closed containers. Elevated temperatures can accelerate this reaction.

Reaction with water will generate heat. Avoid contact with water (moisture), acids, alcohols, amines, ammonia, bases, metal compounds, strong oxidizers, or moist organic absorbents. Avoid contact with metals such as aluminum, zinc, brass, tin, or galvanized metals.

Modified isophorone diisocyanate products can react with themselves (polymerize) at temperatures above 130°C (266°F). Polymerization can be catalyzed by strong bases and water.

During a fire, smoke may contain IPDI in addition to toxic and/or irritating compounds. Hazardous combustion products may include, but are not limited to: nitrogen oxides, isocyanates, carbon monoxide, carbon dioxide and hydrogen cyanide.

TRAFFIDECK™ Topcoat UV40(S) contains xylene and is flammable. No smoking, open flames, or sources of ignition should be permitted in handling and storage areas. Electrically bond and ground all containers and equipment before transfer or use.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group or through the appropriate Polyurethanes Regional Call Center.
References

4. TRAFFIDECK Waterproofing and Surfacing Systems: Product Profile, Hyperlast Limited (a subsidiary of The Dow Chemical Company), pages 1 and 2.
14. TRAFFIDECK Waterproofing and Surfacing Systems: Product Profile, Hyperlast Limited (a subsidiary of The Dow Chemical Company), pages 1 and 2.

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