Questions and Answers About Safe Use and Handling

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Table of Contents

I. Purpose

The purpose of this document is to provide answers to common questions pertaining to Covestro isocyanate-containing products. Covestro's Product Safety and Regulatory Affairs Department supports product stewardship activities contributing to the safe use and handling of Covestro products. One approach to promoting safe use and handling of isocyanate products is through product safety literature.

Monomeric and polymeric isocyanate products have been used in industry for over 50 years. All the diisocyanate monomers listed below can be used to make various types of polyisocyanate products.

- Toluene diisocyanate (TDI)
- Diphenylmethane diisocyanate (MDI)
- Hexamethylene diisocyanate (HDI)
- Isophorone diisocyanate (IPDI)
- 4,4-Methylene dicyclohexyl diisocyanate (H_{12}MDI, referred to as HMDI throughout this document)

This document provides information related to chemical/physical properties of diisocyanates, health effects, air monitoring, exposure guidelines, personal protective equipment (PPE), first aid, spill response and disposal of waste material. Throughout this document the term "isocyanates" refers to the diisocyanate monomers listed above and the polyisocyanate products manufactured from these monomers.

II. Chemical and Physical Properties of Isocyanate Products

1. Question: What is an isocyanate?

Answer: An isocyanate is any chemical that contains at least one isocyanate group in its structure. An isocyanate group is a group of atoms containing one nitrogen atom attached by a double bond to one carbon atom, which in turn is attached by a second double bond to an oxygen atom (-N = C = O). A chemical containing two such groups is called a diisocyanate. Common examples are toluene diisocyanate (TDI), hexamethylene diisocyanate (HDI), isophorone diisocyanate (IPDI), dicyclohexylmethane-4,4'-diisocyanate (HMDI), and diphenylmethane diisocyanate (MDI). These also are often called monomers because they can be made to react with one another and various other chemicals to form large chain- like chemicals called polymers. Prepolymers are intermediate in size between the small diisocyanate monomers and the very large polymers, which often are called polyisocyanates.

2. Question: What are isocyanates used for?

Answer: Isocyanates discussed in this brochure are part of a family of chemistry referred to as reaction polymers and are used as building blocks to make polyurethane products. Polyurethane products have widespread application in the aerospace, automotive, appliance, electronics, furniture and construction industry. Isocyanates are used to make products such as coatings, sealants, glues, thermal insulation, mattresses, pillows, seat cushions, vehicle body panels, guide wheels for elevators and escalators, and a variety of sports equipment including running shoes, skis, bowling balls and archery targets.

3. Question: What are some key chemical and physical properties of isocyanates?

Answer: Isocyanates are typically liquids at room temperature. Unlike many liquids such as organic solvents (i.e., mineral spirits), isocyanates are characterized as having little to no odor resulting in poor warning properties, low flammability potential, and low evaporation rates due to their low vapor pressure. Isocyanates are reactive with many other chemicals including alcohols, amines, acids, and even water. This reactivity property contributes to why they are used in many different applications to produce a variety of products. Reactivity also imposes tight constraints on the conditions under which isocyanates are stored and used in the workplace. Other questions in this brochure will help further explain the importance of being aware of the unique chemical/physical properties of isocyanates.

4. Question: Do isocyanates contain cyanide or is cyanide given off during the normal use of isocyanate products?

Answer: Although the two chemical names are similar, no cyanide is used to make or is present in isocyanate products. Cyanide is not released during the normal use/processing of isocyanate products. However, burning any nitrogen-containing material, even those that are not made from isocyanates, can produce hydrogen cyanide (HCN). HCN can be produced from the thermal decomposition (e.g., through burning) of isocyanate-containing materials or polyurethane products (i.e., foam, paints/coatings). In addition, nitrogen-rich materials that are not made from isocyanates that will release HCN when burned include: epoxy/polyamide coatings; melamine coatings; alkyd urea coatings; and natural materials such as wool and leather.

5. Question: How do the various isocyanate products compare with regard to speed of evaporation (also called volatility)?

Answer: Isocyanate products evaporate relatively slowly. In fact, they evaporate at rates hundreds to thousands times slower than other liquids, such as water or organic solvents. Among isocyanates, HDI and TDI evaporate faster than the other isocyanates listed below. IPDI evaporates more slowly. Products classified as very slow to evaporate are MDI, MDI polyisocyanates, HMDI, HDI polyisocyanates and TDI polyisocyanates. In fact, the HDI- and TDI-based polyisocyanates originally were developed to reduce the evaporation rate and thus decrease the inhalation hazard during handling and use.

To illustrate the great difference in speed of evaporation, one can compare the room temperature (20° C) vapor pressures of various materials. On a relative scale, if MDI is assigned a value of 1, the relative vapor pressure numbers would be:

Isocyanate	Relative Vapor Pressure
HDI Polyisocyanates Isocyanurate trimer Biuret	 0.00052 0.93
Mondur® M (MDI)	1
Mondur® MR (polymeric MDI)	1
Desmodur® W diisocyanate (HMDI)	1
Desmodur® I diisocyanate (IPDI)	48
Desmodur® H diisocyanate (HDI)	1,100
Mondur® TD-80 diisocyanate (TDI)	2,500
Water	1,800,000
Solvent (Methyl ethyl ketone)	9,100,000

6. Question: Is exposure likely while handling isocyanates at room temperature?

Answer: For all the isocyanates other than TDI and HDI listed in the table above, air sampling has shown a low probability of airborne isocyanate concentrations exceeding an exposure limit unless they are used in a heated process or spray application. Since TDI and HDI have higher vapor pressures, open transfer of these isocyanates at room temperature can result in high airborne concentrations in the work area. Therefore, care must be taken to prevent inhalation overexposure in work areas where these two isocyanates are handled by using engineering controls (i.e., ventilation) and good work practices.

In addition, it is important to prevent splashing onto the skin or into the eyes when handling open containers or during open processing conditions.

7. Question: Will an isocyanate product spill create a hazardous situation?

Answer: With an isocyanate product spill, the inhalation hazard varies depending on many factors, including how easily that particular isocyanate evaporates, the volume of material spilled, the size of the spill area, the temperature of the spilled material, and the amount of ventilation (air movement in the spilled area). It also depends on whether or not the product contains organic solvents (e.g., n-butyl acetate, ethyl acetate). Organic solvents generally have a much higher vapor pressure than isocyanates and may cause the product to be labeled as a flammable liquid.

Since it is difficult to predict all of these factors, it is best to institute a standard spill cleanup procedure for all isocyanate spills (see Section VII of this document or Section 6 of the SDS). During isocyanate spill response activity, measures must be taken to wear the appropriate personal protective equipment (PPE) based on the site emergency response plan. In particular, measures must be taken to prevent direct skin contact during cleanup and to wear proper respiratory protection when the airborne isocyanate concentration level is unknown.

Spills of TDI and HDI monomer products may be of particular concern because of the vapor pressure of these two isocyanates. Even at room temperature, the vapor pressure associated with these two isocyanate products can result in airborne concentrations above the TLV or PEL.

III. TLVs, PELs, Manufacturers' Guidelines and How to Know Whether Your Operation Meets or Exceeds These

1. Question: What is a TLV?

Answer: TLV stands for Threshold Limit Value. These values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. They are guidelines that are recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs should not be regarded as fine lines between safe and dangerous concentrations. They are not a relative index of toxicity. Some individuals may be unusually susceptible and react to concentrations lower than the TLV. For example, an individual may become "sensitized" to certain chemicals such as amines, epoxy resins or isocyanates and then react to concentrations below the TLV. Therefore, a TLV may not protect a sensitized individual. (See Section V).

Please read the current issue of *Threshold Limit Values and Biological Exposure Indices* published by the ACGIH for a more complete description of TLVs (www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations/overview).

2. Question: What is a PEL?

Answer: PEL stands for Permissible Exposure Limit and refers to airborne concentration standards established by the Occupational Safety and Health Administration (OSHA). These can be found in Title 29 of the Code of Federal Regulations (CFR), Section 1910.1000, or in one of the chemical-specific OSHA regulations. PELs are exposure limits enforceable by OSHA. Some states administer their own OSHA programs. These states sometimes issue PELs which may be equal or more stringent than those established by federal OSHA.

3. Question: What is a Manufacturer's Exposure Guideline?

Answer: Manufacturers may suggest an airborne concentration guideline for worker exposure. This is typically done in cases where there is not a published TLV or PEL for a substance. The manufacturer exposure guidelines are typically found on the safety data sheet.

4. Question: What is the best source of information concerning TLVs, PELs, or manufacturer's guidelines for Covestro isocyanate products?

Answer: The best source of information is the most current Covestro safety data sheet (SDS). An SDS can be obtained by accessing Covestro's product stewardship website, Product Safety First, at https://www.productsafetyfirst.covestro.com/en/sdssearchpage/sds/ or calling the Covestro Product Safety Department at 412-413-2835.

5. Question: Do isocyanates have a detectable and distinctive odor or warning property to indicate that the airborne concentration is above the occupational exposure limit (OEL) or guideline?

Answer: Odor is sometimes considered to be an important signal for the presence of a chemical in the workplace. Unfortunately, the occupational exposure limit values for isocyanates are generally lower than the odor threshold (lowest level at which the odor can be detected) and the level at which irritation occurs.

Isocyanates do not have a similar and distinctive odor that can easily be identified which makes establishing reliable odor threshold levels difficult.

In summary, isocyanate users cannot tell by their senses alone if they are exposed to airborne concentrations exceeding the allowable limit (TLV, PEL or manufacturers' guidelines).

To ensure that published exposure limits have not been exceeded, monitoring for the airborne isocyanate should become part of the overall employee exposure characterization program. NIOSH, OSHA, Covestro, and others have developed sampling and analytical methods.

6. Question: Can Covestro assist a customer or end-user who needs help performing air monitoring?

Answer: Yes. Requests for such assistance should be directed to your Covestro technical, sales or marketing representative. If you are unable to identify your Covestro representative, you can directly contact the Covestro Product Safety Department at 412-413-2835.

IV. Health Effects of Isocyanate Overexposure

1. Question: What are the primary health effects of overexposure to isocyanate products?

Answer: Overexposure to isocyanate products can cause skin, eye, nose, throat, and lung irritation. It also can lead to skin or respiratory sensitization. For a more complete list of health effects and symptoms of the specific product in question, consult the product specific SDS.

2. Question: What is sensitization?

Answer: Individuals may develop respiratory (asthma or asthma-like symptoms) or skin sensitization to isocyanates that may cause them to react to a later exposure to isocyanates at low levels (well below the TLV or PEL, in the case of respiratory sensitization).

Respiratory sensitization can occur as a result of repeated short term overexposures or after a single high level exposure. Respiratory symptoms can include chest tightness, wheezing, cough, shortness of breath or asthmatic attack. Extreme asthmatic reactions can be life threatening. 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 severe cases for several years. Chronic overexposure to diisocyanates has also been reported to cause lung damage (including fibrosis, decrease in lung function) that may be permanent.

Dermal exposure may contribute to development of sensitization to diisocyanates. Skin sensitization symptoms can include reddening, itching, swelling, and rash. Animal tests and other research indicate that skin contact with diisocyanates can play a role in causing isocyanate sensitization and respiratory reaction.

3. Question: If people become sensitized, can they lose their isocyanate sensitivity after being removed from further exposure?

Answer: Sensitization can be permanent. There have been documented cases in which individuals have lost their sensitivity to isocyanates based on direct challenge testing at levels below allowable limits. However, since such individuals may have an increased susceptibility to isocyanate sensitization, they should have no future contact with isocyanates.

4. Question: Can sensitization be caused by skin contact or only by inhalation?

Answer: Prolonged skin contact with diisocyanates can cause reddening, rash, swelling, and, in some cases, skin sensitization. In addition, animal tests and other research indicate that skin contact with diisocyanates can play a role in causing isocyanate sensitization and respiratory reaction.

5. Question: Is there any way to prescreen individuals to determine if they are likely to become sensitized to isocyanates?

Answer: There is no simple test which can be done to identify people most susceptible to sensitization. Applicants assigned to an isocyanate work area should undergo a preplacement physical evaluation. Special attention should be directed to diseases of the respiratory system or abnormal pulmonary function.

Each applicant should complete a medical, occupational and respiratory disease questionnaire. History of adult asthma, respiratory allergies such as severe hay fever, eczema, history of prior isocyanate sensitization, or lack of smell (anosmia) are possible reasons for medical exclusion from isocyanate areas.

In addition to the questionnaires, applicants should have a physical examination, including a thorough skin inspection, examination of the heart and lungs, and a baseline pulmonary function test.

While using or handling the isocyanate products, emphasis should be placed on keeping all workers' exposure consistently below the TLV, PEL or manufacturers' guidelines. Workers also should be medically evaluated on an annual basis, with the frequency of pulmonary function testing dependent upon the workers' potential for isocyanate exposure.

6. Question: If a sensitized person is exposed to isocyanates, will the reaction be immediate or delayed?

Answer: Some can react immediately, some may not react until several hours after the exposure, and a third group can have both immediate and delayed reactions.

7. Question: Can exposure to isocyanates cause an asthmatic reaction?

Answer: Yes. Overexposure to isocyanates can result in sensitization which, in turn, can cause asthma. People who have had a single high level exposure or repeated exposure to levels above the TLV, PEL or manufacturers' guideline, may develop isocyanate sensitization. This may cause a reaction to future exposures at very low levels, even below the levels that may be considered safe for others. In addition, reports have shown that sensitized persons can develop a reactive airways condition which can cause an asthma-like reaction from exposures to agents other than isocyanates. According to some reports, this condition may persist for several weeks, months or years after removal from further isocyanate exposure. There is some evidence that the earlier a sensitization condition is identified and the person is removed from work with isocyanate products, the less likely that individual will experience a long-term reactive airways condition.

8. Question: Can isocyanates cause sterility, birth defects or reproductive problems?

Answer: There is no scientific human evidence that isocyanates cause sterility, birth defects or reproductive problems. In addition, animal studies exposing rats to TDI, MDI or HDI by inhalation did not show any evidence of birth defects (teratology). Rats exposed, via inhalation, in a two-generation reproductive study for TDI and in a one-generation study for HDI did not show any effects on mating, gestation, or lactation. Inhalation exposure in animals did not show evidence of impaired fertility or birth defects and minor developmental effects were only observed at concentrations that induce significant maternal toxicity.

9. Question: Can isocyanates cause cancer?

Answer: While some animal studies have found evidence that isocyanates can induce cancer in rodents, scientific evidence has found that none of the diisocyanates are carcinogenic to humans under relevant exposures. In addition, epidemiological data do not demonstrate a carcinogenic risk for workers using diisocyanates.

For more information please see the following website: https://dii.americanchemistry.com/Frequently-Asked-Questions/

V. Avoiding Isocyanate Overexposure

1. Question: How can isocyanate overexposure be controlled?

Answer: Good engineering controls such as exhaust ventilation and enclosure of the operation are the preferred methods of control. In some cases, however, additional precautions such as the wearing of personal protective equipment (PPE) may be necessary. Where the potential for direct skin contact exists, protective clothing and gloves are recommended. Protective clothing can include a disposable coverall or work uniform. Chemical resistant gloves such as nitrile, butyl rubber and neoprene may be used. In inadequately ventilated environments or if airborne concentrations are unknown, respiratory protection should be worn.

Respirator guidelines can differ somewhat depending on the product involved and the application. Contact the Covestro Product Safety Department at 412-413-2835 for help in selecting appropriate PPE.

2. Question: Can air-purifying respirators be used in isocyanate work areas?

Answer: Yes. An air-purifying respirator (APR) may be selected for use during a work task if the airborne isocyanate concentration is not greater than 10 times the occupational exposure limit (ACGIH TLV, OSHA PEL). The recommended APR cartridge is an organic vapor/particulate filter combination cartridge (OV/P100). If an APR is selected then a change-out schedule must be developed and implemented. This change-out schedule should be based on objective information or data that will ensure that the cartridges are changed out before the end of their service life. A respirator program that complies with the requirements set forth in OSHA's Respiratory Protection Standard (29 CFR 1910.134) must be established by the employer.

3. Question: What type of respirator is recommended for manual spray application of an isocyanate-containing product (e.g., production shop/auto-refinish shop)?

Answer: For manual spray application of an isocyanate-containing product, Covestro typically recommends either a loose-fitting powered air-purifying respirator (PAPR) or a supplied-air respirator (SAR) equipped with a loose fitting hood or helmet. For the PAPR unit, follow the same guidance as described in question #2 with regard to cartridge use/replacement. These respirators provide better skin/eye protection and have higher assigned protection factors than a half-mask APR. A half mask APR may be selected for some spray application tasks depending upon the airborne concentration (< 10 times the TLV/PEL), spray time, volume of material sprayed and effectiveness of engineering controls (i.e., ventilation). Care must be taken to provide adequate eye protection if a half mask APR is selected.

4. Question: What are the requirements to ensure breathing air is provided to a supplied-air respirator?

Answer: Supplied-air respirators (SARs) may consist of a full facepiece, half-facepiece, or a loose-fitting hood/helmet to which breathing air is supplied through a flexible hose connected to an air source. One of the most common types of SAR used involves the supply of a continuous flow of air to the facepiece or hood/helmet keeping it under a positive pressure and not allowing airborne contaminants to enter.

For all SARs, the air supplied from the source must meet the requirements of the American National Standards Institute (ANSI) and the Compressed Gas Association (CGA) G7.1 for Type 1, Grade D breathing air.

The source of the breathing air supplied to the respirator can be an oil-lubricated compressor or a free-air (ambient air) pump. If an oil-lubricated compressor is used as the source, there are requirements for in-line filters and a carbon monoxide monitor to ensure Type I, Grade D air is provided.

5. Question: Where can air purifying and/or air-supplied respirators be obtained that are suitable for use with polyurethane applications?

Answer: There are a number of companies that sell these respirators. The Covestro Product Safety Department can be contacted for current vendor information. However, the end user is responsible for determining whether a vendor's products are suitable for their particular use.

6. Question: If my clothing has been contaminated while working with isocyanates, should they be left at work and decontaminated/discarded?

Answer: Yes. Work clothes should be left at work and decontaminated or discarded. A clothing procedure such as this is a prudent precaution when working with any chemical. Work clothes with minimal isocyanate contact can be decontaminated by washing with soap and water. The water itself will react with the isocyanate to produce polyureas which have much lower toxicity than isocyanates. Large spills on clothing may result in a hard polyurea coating forming on the clothing. This may make the clothing unfit for reuse. Under no circumstances should clothing or equipment contaminated or potentially contaminated by an isocyanate be taken home by a worker.

Protective clothing (disposable coverall or work uniform) is recommended for tasks where the likelihood of skin contact exists. All protective clothing must be carefully removed to avoid skin contamination. If the clothing is reusable, plans must be established to clean the clothing before reuse. Any clothing or disposable protective equipment should be promptly and properly disposed of as contaminated waste.

7. Question: Are there sampling methods to assess for the presence of isocyanates on surfaces?

Answer: Commercially available surface contamination wipe test kits are effective in determining surface contamination for isocyanates. These kits may be useful in situations where decontamination of a surface is necessary. When used according to the manufacturer's instructions, a chemical reaction, resulting in color development, takes place on a treated pad after it has been wiped on a surface. The color indicates that isocyanate residue is present on the wiped surface. Two different test kits are currently available: Chemteq® ChemWipes (for TDI and MDI) and SKC Surface SWYPE™ indicators (for all isocyanates referenced in this brochure). Additional information about the wipe test kits may be obtained by contacting a Covestro Product Safety Industrial Hygienist at 412-413-2835.

It has been reported that isocyanates can be persistent and may remain on a surface for several hours after completion of a task or operation. Therefore, when working with isocyanate products it is important that good housekeeping practices be established. See Section 6 of the SDS for information on use of neutralization solutions that have shown to be effective for decontaminating surfaces, tools, or equipment that have been in contact with an isocyanate.

VI. First Aid

1. Question: What should be done if an isocyanate comes in contact with a person's eyes?

Answer: Flush the eyes immediately with the contents of several sterile eye wash bottles or copious amounts of lukewarm water. Then remove contact lenses, if present and easily removable, and continue eye irrigation for at least 15 minutes. Obtain medical attention.

2. Question: What should be done if an isocyanate contacts a person's skin?

Answer: If direct skin contact with an isocyanate occurs, immediately wipe off the isocyanate product from the skin using dry towels or other similar absorbent fabric. If readily available, apply a polyglycol-based cleanser (e.g., SKC D-TAM™ Skin Cleanser) or corn oil. Wash with soap and warm water and pat dry. If a polygloycol-based cleanser or corn oil is not available, wash with soap and warm water for 15 minutes. If available, use a wipe test pad to verify decontamination is complete (e.g. SKC SWYPE™). Get medical attention if irritation develops or persists after the skin is washed. Discard or wash contaminated clothing before reuse. It is recommended that employees be provided with unimpeded access to a safety shower and eyewash facility in all areas where isocyanates are being unloaded, transferred, mixed or handled.

3. Question: What should be done in case of inhalation overexposure to an isocyanate?

Answer: Move the affected person to an area free from further exposure and get medical attention.

4. Question: What should be done if a person ingests (swallows) an isocyanate material?

Answer: Do not induce vomiting. Wash mouth out with water. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

VII. Spill Cleanup and Disposal of Isocyanate Wastes

1. Question: What is the recommended cleanup procedure for spilled isocyanate material?

Answer: Implement site emergency response plan. Evacuate non-emergency personnel. The magnitude of the evacuation depends upon the quantity released, site conditions, and the ambient temperature, since higher levels of airborne isocyanates may be expected as ambient temperatures increase. Isolate the area and prevent access of unauthorized personnel. Notify management. Call CHEMTREC at 800-424-9300 for assistance and advice.

Wear appropriate personal protective equipment (PPE) as specified in Section 8 of the applicable Covestro SDS. Ventilate and remove ignition sources. Control source of the leak. Contain the released material by damming, diking, and retaining, or diverting into an appropriate containment area.

Absorb or pump off as much of the spilled material as possible. When using absorbent, completely cover the spill area with suitable absorbent material (e.g., vermiculite, kitty litter, Oil-Dri®). Allow for the absorbent material to absorb the spilled liquid. Shovel the absorbent material into an approved metal container (i.e., 55-gallon salvage drum). Do not fill the container more than 2/3 full to allow for expansion, and apply lid loosely. Repeat application of absorbent material until all liquid has been removed from the surface. Proceed to decontamination of the spill surface.

Decontaminate the spill surface area using a neutralization solution (for detailed information on neutralization solutions, consult Section 6 of the applicable Covestro SDS).Scrubbing the surface with a broom or brush helps the decontamination solution to penetrate into porous surfaces. Wait at least 15 minutes after first application of the neutralization solution before applying absorbent. Cover the area with absorbent material and shovel this into an approved metal container. Check for residual surface contamination using a surface wipe method (refer to Section V for information on surface wipes).

If isocyanate remains on the surface (red color on pad), repeat applications of neutralization solution, with scrubbing, followed by absorbent until the surface is decontaminated (no color change on surface wipe pad). Apply lid loosely to metal waste container (do not tighten the lid because carbon dioxide gas and heat can be generated from the neutralization process). With the lid still loosely in place, move the container to an isolated, well-ventilated area to allow release of carbon dioxide. After 72 hours, seal the container, and properly dispose of the waste material and any contaminated equipment (i.e., broom or brush) in accordance with existing federal, state and local regulations.

2. Question: Is spilled isocyanate material considered hazardous waste?

Answer: Spilled isocyanate material may or may not be considered a hazardous waste, depending upon the isocyanate and any process changes made to it by the product user (i.e., use of a solvent, etc.). Therefore, 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 a hazardous waste. (40 CFR 261.20-24).

For additional information, Covestro recommends the following reference available through the American Chemistry Council Center for the Polyurethanes Industry (CPI): *Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing (Issue AX 151)*.

Of the five isocyanates discussed in this document, only TDI is defined as a hazardous waste within 40 CFR 261. Toluene diisocyanate (TDI) appears on the U-list and has an identification number of U223.

3. Question: What disposal method does Covestro recommend for isocyanates?

Answer: Waste disposal should be in accordance with existing federal, state and local environmental control laws. Incineration is the preferred method. Contact and follow the guidance of a licensed disposal facility to properly dispose of unused product or chemical waste.

4. Question: Is it true that drums which contain isocyanate products are considered to be hazardous waste?

Answer: Only drums that contain an EPA listed hazardous waste material or is hazardous by characteristic (toxic, reactive, corrosive or ignitable) would be considered hazardous waste, unless deemed legally “empty” in accordance with 40 CFR Section 261.7. For example, a discarded drum that contains TDI and is not “empty,” would be considered a hazardous waste.

5. Question: When is a drum that contained a hazardous waste considered empty?

Answer: The definition of an empty drum is defined in the RCRA federal regulation, 40 CFR Part 261.7. Under federal regulations, containers are considered empty if:

- All wastes have been removed using practices commonly employed to remove materials from the type of container (e.g., by pouring, pumping or aspirating); and
- Less than 2.5 centimeters (one inch) of residue remain on the bottom of the container or inner liner, or
- Less than 3 percent of the weight of the total capacity of the container remains in the container or inner liner, if the container is less than or equal to 119 gallons in size, or
- Less than 0.3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 119 gallons in size

See 40 CFR Section 261.7 for the Environmental Protection Agency (EPA) definitions of empty containers. Applicable state laws and regulations should also be consulted.

In general, there should be no free liquids in an "empty" container. While "empty" containers may not always be subject to RCRA, the disposal still may create liabilities. Even empty containers can retain product residue which may be harmful to health. Therefore, it is important ensure proper disposal of chemical containers such as drums. Good practice is to contact a professional drum re-conditioner, professional scrap metal recycler, or an approved landfill.

6. Question: Should empty drums be given, donated or sold to anybody?

Answer: No. It is the responsibility of the user to ensure that drums are transferred to a responsible party who will properly recondition or destroy the drum to prevent reuse. Indiscriminately discarded drums could be converted wrongfully for recreational use, which could result in injury (for example, exposure to decomposition products (see Section VIII, Thermal Decomposition or Burning).

7. Question: Should a torch be used to destroy a drum?

Answer: No. Applying a flame or heat to a drum may result in explosive and/or toxic decomposition of residues. Drums should be cut or destroyed by mechanical means only. (See Section VIII, Thermal Decomposition or Burning).

8. Question: How can a company that reclaims and reconditions drums be located?

Answer: A state-by-state list of drum reconditioners can be obtained from the Reusable Industrial Packaging Association (www.reusablepackaging.org).

It is important to remember that some isocyanate products are not hazardous by either listing or characteristic under the Resource Conservation and Recovery Act (RCRA) regulations, but are nevertheless potentially dangerous if an unsuspecting employee of a disposal or reclamation facility comes in contact with them. Therefore, it is essential that the reclaimer or disposer be notified of the previous contents of the drums and of the hazards associated with those contents. In addition, state or local regulations and site restrictions may be more stringent than federal law. A regional EPA office or equivalent state agency may be helpful in interpreting local regulations.

9. Question: How can a copy of the current federal regulations on hazardous wastes be obtained?

Answer: Title 40 Code of Federal Regulations Parts 260-299 (RCRA) can be found on the U.S. Government Bookstore website.

10. Question: How can EPA be contacted to request assistance/advice regarding disposal of hazardous waste?

Answer: Call EPA's RCRA Hotline: 202-566-0270.

VIII. Thermal Decomposition or Burning

1. Question: Do isocyanates present a fire risk?

Answer: HDI, HMDI, IPDI, TDI, and MDI and their polyisocyanates, have relatively high flash points and are not considered to be flammable; however, each will burn if heated sufficiently. Under the National Fire Protection Association (NFPA) they are classified as Class IIIB combustible materials. This means that they may burn in the presence of an existing fire or heat source and adequate oxygen.

Isocyanates involved in a fire will emit toxic gases and vapors. All personnel dealing with such incidents should wear complete emergency response equipment. The use of a self-contained breathing apparatus (SCBA) is essential.

To minimize the risk of rupture for containers during a fire, containers should be kept cool by spraying with cold water on the outside of the container. Closed containers of isocyanate-containing products may rupture when exposed to extreme heat due to build-up of pressure from thermal degradation and/or carbon dioxide generation.

Suitable extinguishing agents include:

- Dry chemical powder
- Carbon dioxide
- Water
- Foam

After the fire has been extinguished, the area is not considered safe until a thorough inspection for residual isocyanates has been conducted by qualified persons wearing proper personal protective equipment. Decontaminate any suspect residues with a neutralizing solution. For detailed information on recommended neutralization solutions, consult Section 6 of the applicable Covestro SDS.

2. Question: What gases and vapors can be generated during a fire or while cutting/welding on a polyurethane material?

Answer: During a fire or when performing hot work on polyurethane material, emissions can include isocyanates, in addition to:

- Carbon monoxide
- Carbon dioxide
- Hydrogen cyanide
- Oxides of nitrogen
- Hydrocarbons
- Isocyanic acid

IX. Training Resources

1. Question: ***What assistance can Covestro offer to customers who wish to train their employees?***

Answer:

1. Product safety literature including safety data sheets
2. Customer-site seminar conducted by a Covestro industrial hygienist
3. Phone consultation: 412-413-2835
4. Covestro's product stewardship website: https://www.productsafetyfirst.covestro.com/

References

https://dii.americanchemistry.com/Frequently-Asked-Questions/

https://adi.americanchemistry.com/Frequently-Asked-Questions/

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Covestro LLC
Product Safety and Regulatory Affairs Department

For more information, please visit us at:
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