

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

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Purpose

This purpose of this guide is to help processors of polyurethane chemicals manage resulting waste chemicals and empty containers in a responsible manner that conforms to federal and state regulations. In particular, this guide focuses on those chemicals used in polyurethane processing operations that may be regulated as hazardous waste.

Table of Contents

Purpose.....	1
Regulations.....	2
What is a Hazardous Waste?.....	2
Listed Wastes.....	3
Characteristic Wastes.....	4
Consider Special Regulatory Conventions: The Mixture Rule..	4
Consider Exclusions: Empty Containers that Held Hazardous Wastes.....	5
What Responsibilities Does EPA Place Upon Hazardous Waste Generators?.....	5
Recordkeeping Requirements.....	7
Storing Hazardous Waste.....	7
Satellite Accumulation.....	7
Hazardous Waste in a Designated Accumulation Area...	7
Disposing of Hazardous Waste.....	8
Treating or Disposing of Hazardous Waste On-Site.....	8
Where Can I Get More Information?.....	9
Legal Notice.....	10

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

Regulations

Hazardous waste regulations are developed and implemented by the US Environmental Protection Agency (EPA) as directed by Congress in the Resource Conservation and Recovery Act of 1976 (RCRA) and subsequent amendments. EPA's hazardous waste management regulations are currently codified in 40 CFR Parts 260 to 272. Under the regulations, "generators" are defined as entities whose act or process produces hazardous waste or whose act first causes a hazardous waste to be subject to regulation. The RCRA regulations impose various requirements upon hazardous waste generators including waste classification, waste accumulation, treatment and disposal, transportation manifests, recordkeeping, and emergency preparedness. RCRA envisions parallel federal and state regulatory and enforcement programs, in which EPA adopts generally applicable standards and approves state programs that satisfy federal requirements. At the time of publication, EPA has authorized hazardous waste management programs for 50 states and territories. These state regulations are often identical in substance to the federal regulations. However, state programs may also be more stringent or more extensive than the corresponding EPA regulations. Moreover, in some cases, EPA has only authorized portions of state programs. As a result, both federal and state regulations may be in effect, depending on the state. A generator can contact their state solid and hazardous waste officials or the EPA Regional office for more information.

What is a Hazardous Waste?

EPA defines hazardous waste in 40 CFR § 261. In order for a waste to be hazardous waste, it must first meet the EPA definition of "solid waste." Hazardous wastes are a subset of solid waste.

The term "solid waste" is used very broadly in RCRA and refers to both non-hazardous and hazardous waste, including not only solids, but also semisolids, liquids, sludges, and compressed gases. Materials that are being disposed of, or are accumulated, stored, or treated before or instead of being disposed of, are solid waste. Also, spent materials that are accumulated, stored or treated before being recycled are usually solid waste. Generally, chemicals stored with no possibility of use or reclamation are solid waste. The regulations do contain provisions that allow certain types of recycled materials to be excluded from regulation as either a solid or a hazardous waste. However, these recycling provisions (found at 40 CFR § 261.1 and § 261.2) are very complex and careful analysis would be necessary before relying on this exclusion. Generally speaking, if materials are burned for energy recovery, placed on the ground, or stored for long periods of time while waiting to be recycled, EPA will likely regard the materials as solid/hazardous wastes subject to regulation.

Simply defined, a hazardous waste is waste with properties that make it dangerous or potentially capable of having a harmful effect on human health or the environment if not managed correctly. A solid waste is considered hazardous if (1) it is a listed hazardous waste published by EPA in 40 CFR § 261, Subpart D or (2) exhibits at least one of the four hazardous characteristics defined in 40 CFR § 261, Subpart C. Listed and characteristic hazardous wastes are identified using EPA codes consisting of one letter followed by three digits. Some states may use additional codes for state specified hazardous or "special" waste streams. For listed wastes, the first letter in the code corresponds to the common list name (e.g., "F-list"). The first letter in the codes of characteristic wastes is D. Generators of hazardous wastes are required by law to identify their hazardous wastes with all applicable codes. As such, a listed hazardous waste that exhibits a hazardous characteristic must be identified with both the applicable listed and characteristic waste codes.

EPA views hazardous waste as being regulated from its "point of generation," which often means when it is first removed from a manufacturing process. There is not a single list of hazardous waste

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

that is continuously updated; rather determining whether a waste is a hazardous waste is a process that involves a series of steps. Importantly, it is incumbent upon the generator to determine whether waste materials that result from their activities are a hazardous waste pursuant to 40 CFR § 262.11. To determine if a waste is a regulated hazardous waste, the generator first needs to determine whether the waste fits within the definition of “solid waste” in accordance with 40 CFR § 261.2 and, if so, whether the waste is excluded from regulation under 40 CFR § 261.2 or 261.4. Next, the generator needs to examine whether the waste is listed as a hazardous waste in 40 CFR Part 261, Subpart D. Finally, the generator needs to consider whether the waste exhibits one or more of the hazardous characteristics identified in 40 CFR § 261, Subpart C. In making these determinations, generators may use either analytical testing or their knowledge regarding the process that generates the waste. Wastes such as outdated raw materials may not require testing since knowledge of the chemicals’ origins and characteristics may be applied in the determination. Often, Safety Data Sheets (SDSs) can be useful for this purpose. Generators should refer to 40 CFR § 261.2 for more information.

Listed Wastes:

There are four primary lists of hazardous wastes. To determine if a waste is a “listed waste,” a generator must have knowledge of the waste’s origin. The lists are described briefly below, but complete lists are included in 40 CFR § 261.

- **F-list [40 CFR § 261.31]** – The F-list designates hazardous wastes from common industrial and manufacturing processes, such as spent solvents, electroplating wastes, wood-preserving wastes, certain landfill leachates, and more. Polyurethane processors may generate F-listed spent solvents (e.g., used methylene chloride, acetone, toluene, etc.). Spent solvents on the F-list are designated by the codes F001, F002, F003, F004 and F005.
- **K-list [40 CFR § 261.32]** – The K-list designates hazardous wastes from specific industries (e.g., ink formulating, petroleum refineries and metal smelting). It is unlikely that polyurethane processors generate K-listed hazardous waste, but refer to 40 CFR § 261.32 to review the list.
- **P-list [40 CFR § 261.33(e)]** – The P-list applies to unused discarded commercial chemical products with a sole-active ingredient found on the P-list. Off specification materials, container residues and spill residues of P-listed materials are also P-listed wastes. P-listed wastes are “acutely hazardous wastes” and are subject to more stringent management standards than other hazardous wastes. It is unlikely that polyurethane processors will generate P-listed hazardous waste; however, processors should review the P-list to confirm.
- **U-list [40 CFR § 261.33(f)]** – The U-list works similar to the P-list. The U-list applies to unused discarded commercial chemical products with a sole-active ingredient included on the U-list. Off-specification materials, container residues and spill residues of U-listed materials are also U-listed wastes. Toluene diisocyanate (TDI) (U223), 4,4’ - Methylene bis-(ortho-chloroaniline) (MBOCA) (U158), n-Dioctylphthalate (DOP) (U107), and methylene chloride (U080) are examples of chemicals used in the polyurethane industry that, upon disposal, may be U-listed hazardous wastes. Although discarded TDI is a U-listed waste, discarded TDI prepolymers are not. In a TDI prepolymer, there may be some free TDI, but it is not the “sole active ingredient.” On the other hand, if pure TDI were spilled, all of the spill cleanup material would be U223. Similarly, in a B-side formulation with polyol and MBOCA, MBOCA is not the “sole-active ingredient” and therefore the B-side waste would not be listed. However, cleanup of a pure MBOCA spill would retain the U158 hazardous waste listing.

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

Additional information describing the materials that are included in particular listings is usually found in the Federal Register notices in which the listing was proposed and adopted, as well as in related EPA guidance materials.

Characteristic Wastes:

EPA has identified four hazardous waste characteristics: ignitability, corrosivity, reactivity and toxicity. Generators may use testing or knowledge to determine if their wastes exhibit one or more of the characteristics.

- **Ignitability [40 § CFR 261.21]** – Ignitable wastes, denoted by the code D001, identifies wastes that can readily catch fire and/or sustain or promote combustion (i.e., strong oxidizers, spontaneously combustible materials). Generally, liquid wastes with a flash point below 60°C (140°F) in a closed-cup test are ignitable.
- **Corrosivity [40 § CFR 261.22]** – Corrosive wastes, denoted by the code D002, identifies wastes that are acidic or alkaline (basic), generally in an aqueous solutions with a pH ≤ 2 or ≥ 12.5 .
- **Reactivity [40 § CFR 261.23]** – Reactive wastes, denoted by the code D003, are those wastes that are generally unstable, explosive, capable of detonation when heated under confinement, react violently with water or generate toxic gases, vapors, or fumes in dangerous quantities when mixed with water. Also, wastes are reactive if they generate toxic levels of cyanide or sulfide gas when exposed to pH between 2 and 12.5.
- **Toxicity [40 § CFR 261.24]** – Toxic wastes, denoted by the codes D004 through D043, are wastes containing certain regulated constituents. To determine if a waste exhibits the characteristic of toxicity, the waste is subjected to the toxicity characteristic leaching procedure (TCLP). TCLP identifies wastes that are likely to leach hazardous concentrations of regulated constituents above specified thresholds (mg/L) in simulated landfill conditions. Regulated constituents include various organic chemicals (e.g., chlorinated solvents, volatiles and semi-volatiles), pesticides and heavy metals (e.g., mercury, lead, and cadmium).

The regulations do not require generators to conduct testing in order to characterize a particular wastestream. However, EPA enforcement personnel may take the position that if subsequent testing shows that the generator's "knowledge based" characterization was incorrect, the generator could be subject to enforcement action.

Consider Special Regulatory Conventions: The Mixture Rule

EPA has adopted what is known as the "mixture rule." The rule regulates any mixing of hazardous waste with non-hazardous waste – especially when listed wastes are concerned. In most cases, if a non-hazardous or characteristic waste is mixed with a listed waste, the entire resulting mixture is considered to be the listed hazardous waste and the original listed waste code applies to the mixture. Processors may wish to segregate listed wastes from non-hazardous waste because mixing listed waste with non-hazardous waste results in the generation of increased volumes of listed hazardous waste. Under certain circumstances, characteristic wastes may be treated to make a non-hazardous waste (i.e., the resulting waste stream would no longer exhibit the hazardous property). Generators should therefore use caution when mixing hazardous wastes with another material in order to treat the wastes. With a few exceptions, facilities treating hazardous waste must have RCRA permits. These exceptions are discussed below.

Consider Exclusions: Empty Containers that Held Hazardous Wastes

Empty containers that once held hazardous chemicals are not regulated as hazardous waste if they meet the definition of “empty.” Under federal regulations, a container is considered empty if:

- All waste has been removed using practices commonly employed to remove materials from that type of container (e.g., by pouring or pumping) and less than one inch of residue remains on the bottom of the container or inner liner, and
- No more than 3% of weight of the total capacity remains in a container or inner liner if the container is less than equal or equal to 119 gallons in size; or
- No more than 0.3% 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 (40 CFR § 261.7(b)(1)).

In general, there should be no free liquids in an “empty” container. Containers that held acutely hazardous waste (e.g., P-listed waste) are considered empty only after being triple rinsed or cleaned by another method capable of removing the acute hazardous waste residue. The solvent rinsate is then managed as acute hazardous waste, see 40 CFR § 261.7(a). (Note also that the material that is removed from the container to achieve the criteria described above may itself be a hazardous waste.)

While “empty” containers may not always be subject to RCRA, the disposal still may create liabilities. Options for managing RCRA empty containers include:

- Arrange with the raw materials supplier to accept return drums.
- Ship empty drums to a drum reconditioner or a scrap recycler. In either case, these facilities should be investigated with care, as some drum recyclers and scrap facilities have ended up as federal or state Superfund sites. For more information on drum recycling facilities, see <http://www.reusablepackaging.org>.
- Disposal of drums into the local landfill is almost never an option since most landfills have an outright ban on accepting recognizable drums and other containers over a certain size. In some cases, processors may be able to destroy the drums (e.g., using a drum crusher) and send them to a landfill. Still, sending empty drums to a landfill can pose long-term liability issues if the landfill is ever found to be contaminated. Some processors have found that receiving raw materials in returnable shipping containers (e.g., totes) instead of drums is an option.

What Responsibilities Does EPA Place Upon Hazardous Waste Generators?

EPA imposes numerous requirements upon hazardous waste generators which govern all aspects of a waste management program. These include waste classification, storage, reporting and recordkeeping, training, and making arrangements for transportation and disposal. For a polyurethane processor, these requirements will vary depending on how much hazardous waste the processor generates in a calendar month. This is because, under EPA rules, there are three classes of generators: large quantity generators (LQGs), small quantity generators (SQGs), and conditionally exempt small quantity generators (CESQGs). SQGs and LQGs are subject to more hazardous waste management requirements as depicted in the table below, while CESQGs are usually subject to very minimal regulation (in most states). Some states define generator status differently and set more stringent or different requirements upon SQGs and CESQGs, so it is important to check the relevant state requirements. Because a facility’s generator status is determined on a monthly basis, it is possible that a facility may be subject to different requirements throughout the year. For example,

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

under the EPA rules, if a facility generates less than 100 kilograms of hazardous waste in January, it would be considered a CESQG and subject to less hazardous waste management requirements for that type of facility. If the same facility generates 500 kilograms of hazardous waste in February, its status would change to SQG and the facility would be subject to the hazardous waste management requirements applicable to that type of facility. Please be aware that acutely hazardous waste has lower thresholds. Some generators take a conservative approach and choose to meet the most stringent requirements at all times, particularly if they know that their facility is likely to change generator status multiple times throughout the year.

Table 1 presents an overview of EPA hazardous waste management requirements that apply to processors depending upon their generator status.

Table 1—Basic Hazardous Waste Generator Requirements*

Requirement (40 CFR § or Part)	CESQG	SQG	LQG
Waste Determination (262.11)	✓	✓	✓
Quality Production Limits (261.5 and 262.34)	≤100 kg/month	100-1,000 kg/month	No Limit
On-Site Accumulation Quantity (261.5 and 262.34)	≤1,000 kg; ≤1 kg acute	≤6,000 kg	No Limit
Accumulation Time (261.5 and 262.34)	No Limit	180 or 270 Days	90 Days
EPA ID Number (262.12)	Not Required ¹	✓	✓
Manifesting (262, Subpart B)	Not Required ¹	✓	✓
Mark Containers “Hazardous Waste” (262.34)	Not Required	✓	✓
Mark Containers with Start Date (262.34)	Not Required	✓	✓
Satellite Accumulation (262.34(c))	Not Required	✓	✓
Personnel Training (262.34 and 265.16)	Not Required	Minimal requirements in 262.34(d)(5)(iii)	✓
Preparedness and Prevention (265, Subpart C)	Not Required	✓	✓
Contingency Planning (265, Subpart D)	Not Required	Minimal requirements in 262.34(d)(5)	✓
Container Management (265, Subpart I)	Not Required	✓ (except 265.176)	✓
Tank Management (265, Subpart J)	Not Required	Only 265.201	✓
Recordkeeping and Reporting (262, Subpart D)	Not Required	Only 262.44	✓
Land Disposal Restrictions (268.7)	Not Required	✓	✓

*Table from EPA’s “RCRA, Superfund and EPCRA Call Center Training Module: Introduction to Generators (40 CFR Part 262), September 2005” modified by the American Chemistry Council, Center for the Polyurethanes Industry.

¹Although not legally required, many transporters will not handle hazardous waste without these items.

Recordkeeping Requirements

As is set forth in the above chart, the regulations impose different recordkeeping requirements upon generators, depending on whether they are CESQs, SQGs, or LQGs. CESQs are essentially exempted from the recordkeeping provisions. By contrast, SQCs and LQCs must prepare manifests before handing over wastes for shipment. Manifests are used to track waste shipments and to verify that they have reached the appropriate destination. A generator can establish a system to verify that signed copies of the manifest are received back from the TSDF to which wastes have been shipped. Recordkeeping requirements are important because federal and state enforcement personnel frequently target recordkeeping errors during site inspections, and thus a failure to maintain adequate records can create a risk of administrative or civil penalties. LQGs are also subject to requirements to prepare for emergencies, train personnel, and have contingency plans, as well as to maintain records demonstrating compliance with these requirements. These requirements are sometimes overlooked by generators and also can be focused on during inspections. Federal and state inspectors often use checklists when they conduct RCRA inspections, and these basic recordkeeping requirements are typically included.

Storing Hazardous Waste

The following discusses some issues required by 40 CFR § 262.34(c).

Satellite Accumulation:

When hazardous waste is accumulating at or near the point of generation (the location where it is initially generated) and is under control of the process operator generating that waste, it is considered to be in a “satellite accumulation area” and is subject to regulatory requirements (40 CFR §262.34(c)). For example, hazardous waste containers must remain closed except when adding waste; containers must be marked with the words “Hazardous Waste” or other words that identify the containers’ contents; containers must be in good condition and compatible with the wastes they contain; and no more than 55 gallons (one drum) of hazardous waste or one quart of acutely hazardous waste may be stored at each satellite accumulation area. The federal rules do not limit the time that wastes can remain in the satellite accumulation container, as long as the above-described quantities are not exceeded. However, some states may limit the time wastes can be accumulated in satellite areas, and thus the state rules should be reviewed to ensure compliance. Under the EPA rules, if the amount of waste in the satellite accumulation area exceeds the specified quantities, the excess amount must be transferred to a designated accumulation area (described below) within three days.

Hazardous Waste in a Designated Accumulation Area:

Once hazardous waste leaves the satellite accumulation area and enters a different location, referred to as an accumulation area, the waste is subject to more requirements. When waste leaves the satellite accumulation area, “the clock starts,” and from this date, the waste must be shipped off-site to a permitted hazardous waste treatment, storage or disposal facility (TSDF) within 90, 180 or 270 days, depending on the generator’s status (e.g., CESQG, SQG, or LQG) and distance from the TSDF (40 CFR § 262.34).

In the accumulation area, all hazardous waste containers must be clearly marked with the date the container was placed in the area. All containers also must clearly be marked “Hazardous Waste.” Emergency equipment shall be maintained at the accumulation area and periodically tested to ensure it is in working order (e.g., communication device or alarm system, fire extinguishers, spill control

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

equipment, etc.)(40 CFR § 262.34 (d)(5)(iv). Waste containers must also be arranged in the accumulation area so that there is adequate aisle space to allow for the flow of emergency personnel and equipment. Incompatible wastes also must be separated to the extent possible using distance, berms, or containment pans. The accumulation area must be inspected weekly for leaks and deterioration, and to ensure adequate spill response materials are on hand.

Disposing of Hazardous Waste

Most generators ship hazardous waste to permitted TSDFs, such as hazardous waste landfills, incinerators, fuel blending, or solvent reclamation facilities. As specified in the EPA regulations, these shipments must comply with the US Department of Transportation (DOT) Hazardous Materials Regulations, 49 CFR § 171-180. Hazardous waste shipments are accompanied by a hazardous waste manifest (shipping paper) and transported by a transporter with and federal Identification Number (40 CFR § 262 Subpart B) (some states have permit requirements for waste transporters). Generators must ship hazardous waste to permitted TSDFs that comply with all procedures (see 49 CFR § 262.21(2)). Prior to off-site disposal, careful waste segregation is important for both safety and economic reasons. For example, if methylene chloride waste is mixed with a B-side polyol blend, then more hazardous waste is generated and the cost of disposal may escalate because of the chlorine content. In addition, such a mixture may decrease the opportunity for fuel blending the polyol or recycling the methylene chloride. Fuel blending and recycling generally are less expensive options and can be more desirable than conventional hazardous waste incineration. TSDFs typically may accept only certain types of hazardous wastes, and many facilities have pre-acceptance approval procedures.

Potential liability may arise from the disposal of all chemical wastes, most particularly hazardous waste. Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or “Superfund”), a generator who arranges for the disposal or treatment, or transportation for disposal or treatment, of a hazardous substance can be held liable for any future remedial costs associated with those substances. The definition of “Hazardous Substance” under CERCLA is considerably broader than and includes RCRA hazardous wastes, as well as MDI, TDI, and other products used in the polyurethane industry. To limit potential liability, processors should follow EPA and DOT requirements on disposing, treating, and transporting all waste.

Treating or Disposing of Hazardous Waste On-Site

In limited circumstances, processors who generate hazardous waste may treat the waste on site. However, before treating hazardous waste, processors should investigate whether the treatment they are planning requires a RCRA treatment permit. In fact, with few exceptions, on-site treatment requires a RCRA permit see 40 CFR § 270. RCRA permits are costly and time consuming to obtain, and may subject a facility to RCRA corrective action which could impose significant additional obligations on the facility. Treating a hazardous waste without a permit when one is required can subject processors to civil penalties or criminal prosecution for noncompliance.

One widely applied type of hazardous waste treatment that usually does not require a permit is elementary neutralization (adjusting the pH of an acidic or basic solution for wastes that only exhibit the characteristic of corrosivity). EPA also allows generators to treat hazardous waste in accumulation containers without a permit, provided that the containers are managed in compliance with EPA’s container management standards in 40 CFR § 265, Subpart I. EPA describes this exemption in its Federal Register (FR) notice dated March 24, 1986 (51 FR 10168) as well as in subsequent FR notices and interpretive memos. This allowance is quite broad in that it does not limit what type of treatment

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

may take place (e.g., precipitation, oxidation/reduction, polymerization). Still, when treating a listed hazardous waste, generally the treatment residue carries the listing of the original hazardous waste. Therefore, the usefulness of this allowance may be limited for listed wastes, because the residue after treatment often retains the hazardous waste listing and must be managed accordingly.

For example, excess, pure TDI waste reacted with a polyol would form an inert polyurethane that may be regulated as U223 hazardous waste. However, excess MDI waste reacted with polyol would not result in a regulated material because MDI is not a U-listed chemical. Processors are cautioned to check with their state regulators before treating any hazardous waste.

Keep in mind that permits for treatment are required for RCRA “hazardous wastes” and state regulated waste streams. Generators may treat wastes that are not regulated as hazardous. In many cases, excess A-side (isocyanate) and B-side (polyol) formulations may be reacted to make non-hazardous solids that may be disposed of with regular trash. Regardless, check with the waste transporter and disposal facility before mixing any non-hazardous waste streams together or with the regular facility trash.

Where Can I Get More Information?

1. www.epa.gov
EPA’s official web site.
2. www.epa.gov/epawaste/index.htm
Links to information concerning permits, storage, disposal, recycling, identification of hazardous waste, regional EPA and state hazardous waste offices and EPA regulations.
3. www.epa.gov/rcraonline
RCRA Online – enables you to search for questions/ answers; guidance documents on all aspects of EPA’s hazardous waste regulations.
4. www.atsdr.cdc.gov
Agency for Toxic Substances and Disease Registry: health effects and minimum risk levels of hazardous chemicals.
5. www.osha.gov/SLTC/hazardouswaste
Safety and health information for hazardous waste handlers (PPE, training, etc.).
6. <http://hazmat.dot.gov>
DOT HazMat site: information regarding regulations governing the transportation of hazardous materials.

Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing

Legal Notice:

These Guidelines were prepared by the American Chemistry Council's Center for the Polyurethanes Industry. They are intended to provide general information on the Resource Conservation and Recovery Act of 1976 (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984. They are not intended to serve as legal advice, a substitute for in-depth training or specific handling or storage requirements, nor are they designed or intended to define or create legal rights or obligations. These Guidelines are not intended to be a "how-to" manual, nor are they a prescriptive guide. All persons involved in the responsible disposal of wastes and containers from polyurethane processing have an independent obligation to ascertain that their actions are in compliance with current federal, state and local laws and regulations and should consult with legal counsel concerning such matters. The Guidelines are necessarily general in nature and individual companies may vary their approach with respect to particular practices based on specific factual circumstance, the practicality and effectiveness of particular actions and economic and technological feasibility. Any mention of specific products in these Guidelines is for illustration purposes only and is not intended as a recommendation or endorsement of such products. Neither the American Chemistry Council, nor the individual member companies of the Center for the Polyurethanes Industry of the American Chemistry Council, nor any of their respective directors, officers, employees, subcontractors, consultants, or other assigns, makes any warranty or representation, either express or implied, with respect to the accuracy or completeness of the information contained in these Guidelines ; nor do the American Chemistry Council or any member companies assume any liability or responsibility for any use or misuse, or the results of such use or misuse, of any information, procedure, conclusion, opinion, product, or process disclosed in these Guidelines. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

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