MOCA SAFE USE GUIDANCE

FOR THE CASTABLE POLYURETHANE INDUSTRY

Prepared by the Polyurethane

Manufacturing Association

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1.0 INTRODUCTION

This MOCA Use Guidance material has been prepared to assist members of the Polyurethane Manufacturers Association ("PMA") in developing appropriate work practices in the use of *4,4' methylene bis (2-chloroaniline),* commonly referred to as "MOCA" or "MBOCA" (CAS No. 101-14-4).

This Guidance is based upon the extensive experience (over 50 years of urinalysis data) of the PMA in dealing with the regulatory issues concerning MOCA, participating in the evolution of recognized industry practices in the safe use of MOCA in the hot cast polyurethane industry, and assisting PMA members in managing consistent compliance with health and safety regulations concerning its use.

This memorandum, and the attached appendices and reference materials, are intended as a supplement to and not a replacement for the product-specific information and instructions provided by MOCA manufacturers and distributors, such as Safety Data Sheets and product literature. Casting processors should review current and future updated MOCA Safety Data Sheets provided by their suppliers. They should also contact their suppliers' Product Safety and Stewardship office for site-specific guidance. This general Guidance is prepared for and intended for the use by PMA members in conjunction with other ongoing PMA programs concerning safety and health regulatory issues applicable to the castable polyurethane industry. PMA freely shares this guidance document with non-member processors and MOCA manufacturers and suppliers to promote safe use. Typically, castable polyurethane processing facilities will have much in common with one another in the use of MOCA. H o wever, there are also important, site-specific differences in each workplace in equipment, layout, and processing methods. Therefore, in developing a MOCA safe use strategy, the process engineering and management staff for each polyurethane processing facility should apply and modify this Guidance to the site-specific circumstances of its particular operation.

Differences from one processor to another may render a certain aspect of this Guidance more critical or require alteration in methods used to control potential employee exposure to the chemical. This guidance has been prepared in an effort to assist PMA members in developing site-specific procedures to achieve consistent compliance with applicable safety and health requirements, and to address risk management.

Regulations administered by the Occupational Safety & Health Administration ("OSHA"), the U.S. Environmental Protection Agency ("EPA") and the U. S. Department of Transportation ("DOT") related to MOCA are intended by Congress and the respective administrative agencies to bring about a reduced potential for MOCA exposure in the workplace, as well as in downstream uses, and to prevent releases of MOCA to the environment and surrounding community. The procedures presented in this Guidance can be of assistance to facility management in addressing regulatory compliance issues in the use of the chemical and in reducing the potential for significant liabilities. Although specific circumstances vary from processor to processor, the following discussion provides a review of considerations that are generally applicable to the use of MOCA throughout the castable polyurethane industry.

Other PMA Guidance and Safe-Use Documents

This MOCA Safe Use Guidance is intended to be used in concert with other PMA guidance and safe use documents and training programs. The following is a list of programs and guidance documents which are available by contacting the PMA office or can be obtained in the members-only section of the PMA website at pmahome.org:

- Isocyanate Safe Handling Training Materials
- MOCA Safe Use Basics (plant level) and Advanced Training Slides (supervisor level)
- Working Safely with Isocyanates and MOCA in Polyurethane Coating Shops by Dr. Theodore J. Hogan

Terms of Use

The Safe Handling of MOCA, Plant Employee Training presentation has been prepared to assist members of the Polyurethane Manufacturers Association (PMA) in developing appropriate work practices in the use of 4,4' methylene bis (2-chloroaniline), commonly referred to as MOCA (CAS No. 101-14-4).

Although the information and recommendations (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, the PMA makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that those using this information will make their own determination as to its suitability for their purposes prior to use. It is the responsibility of those who use this information to ensure their activities comply with federal, state, provincial and local laws, and regulations.

What is MOCA?

MOCA [also called MBOCA and 4,4'-Methylenebis(2-chloroaniline)] is a curative used with isocyanate prepolymers to make castable elastomer products. It is a solid with a melting point of 100 to 110^{o}C (212 to 230^{o}F). MOCA is typically supplied in pellet form. Pellets are light yellow to light tan color. MOCA has a slight aromatic/amine odor. The odor threshold is below the ACGIH TLV TWA 0.01 ppm (0.11 mg/m^{3}). Just because you smell it, does not necessarily mean you have been overexposed.

MOCA is used in the manufacture of polyurethanes (PU). MOCA functions as the chain extender with toluene diisocyanate (TDI) based prepolymer systems. The TDI/MOCA system is very versatile and through variation of the polyol, the component ratios and process parameters like heating and cure times, the material properties of the cast polyurethane can be tailored for specific utilizations.

Key material properties relating to PU product performance include hardness, tensile strength, heat resistance, cut resistance, tear resistance, compression set, resilience, abrasion resistance, hydrolysis resistance, oil resistance and elongation at break. This means that TDI/MOCA PUs do not refer to one specific PU but rather a very large family of PUs with properties that are tailored to where the product (e.g. wheel covers, roller covers, pads, belts) will be used (e.g. industrial installations in mining, metal processing, energy, paper and packaging sectors, conveyance systems, offshore installations). The TDI/MOCA system is also very versatile and can also be used to manufacture both small and large PU parts due to its long pot life.

MOCA: Hazard Communication – Basics

Employees have a right to know about the chemicals in their workplace, the hazards associated with those chemicals, how to protect themselves from the hazards, how to work safely with them, and where to get questions answered. Employees should know the location(s) where Safety Data Sheets (SDSs) are kept and understand the information on SDSs. Employees should also know how to read safety-related information on container labels. If you have any questions including location of SDSs, contact your supervisor.

MOCA: Hazard Communication – MOCA

The following sections of this document contain health and safety information on MOCA. For additional details, see the Safety Data Sheet on this material.

MOCA: Potential Short-Term Effects

- Skin Symptoms:
    - Redness
    - Irritation
    - Allergic skin reaction (rare)
    - Thermal burns if melted MOCA contacts skin.
- Eye Symptoms:
    - Heated vapors can cause eye irritation and severe damage.
- Respiratory Symptoms:
    - Irritation
    - Nausea
    - Headache

MOCA: Potential Long-Term Effects

- In laboratory tests, MOCA has been shown to cause the following types of cancer in animals:
    - Bladder
    - Liver
    - Lung
    - Breast
- MOCA classifications by regulatory body:

- Globally Harmonized System of Classification and Labeling of Chemicals (GHS) – May cause cancer
- American Conference of Governmental Industrial Hygienists (ACGIH) – Suspected Human Carcinogen
- International Agency for Research on Cancer (IARC) – Human Carcinogen

MOCA should be handled as if it is a human carcinogen. Clean personal protective equipment should always be used.

MOCA: Exposure Limits and Routes

- ACGIH Exposure Limit Values:
  - Time Weighted Average (TWA): 0.01 ppm (0.11 mg/m^3) with a skin notation.
- Skin contact is considered to be the primary route of exposure. MOCA absorbs through the skin.
- Inhalation (breathing dust) and ingestion (through eating or drinking) are also potential routes of exposure. Overexposure from vapors is extremely unlikely when proper ventilation systems are in use.
- National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL):
  - Time Weighted Average (TWA): 0.003 mg/m^3
- OSHA Permissible Exposure Level (PEL)
  - None set

MOCA: First Aid

- Inhalation: Move to an area free from the risk of further exposure. If not breathing, or breathing is difficult, seek medical attention. Artificial respiration should be performed if not breathing.
- Skin Contact: Flush skin with plenty of water for at least 5 minutes while removing contaminated clothing and shoes. Wash thoroughly with soap and water. Seek medical attention if irritation or rash develops in the affected area. Thermal burns should be treated as other thermal burns after residual material has been removed from skin. Residual material may be removed by gently scrubbing with soap and water.
- Eye Contact: Rinse with water immediately for at least 5 minutes. If irritation occurs, seek medical attention.
- Ingestion: Seek medical attention.

MOCA: Potential Sources of Exposure

- Sources of MOCA skin exposures:
    - Work area and tools could have surface MOCA contamination. This is a likely source of overexposure.
    - With proper formulation, curing and post-cure, residual MOCA content is anticipated to be low enough not to pose an overexposure risk. Until MOCA has been reacted, there are potential skin exposure issues with handling parts including grinding, sanding, and trimming. This is an unlikely source of overexposure.
- Sources of exposure to air borne MOCA dust particulates:
    - Opening and handling of MOCA drums and liners;
    - Scooping MOCA out of drum and transferring to melters;
    - Handling of empty drums and liners; and
    - Pneumatic MOCA transfer systems (without suitable filters).
- Sources of evaporative (vapor) MOCA exposures (Overexposure from vapors is extremely unlikely):
    - MOCA melters;
    - weighing;
    - transferring molten MOCA to mixers (manual open system);
    - degassing;
    - mixing;
    - pouring;
    - curing; and
    - post-curing.

2.0 SUMMARY

The common use of MOCA by polyurethane manufacturers subjects PMA members to state and local regulatory requirements across the broad framework of safety and health regulations. The PMA has extensive experience in assisting members in managing consistent compliance under these various regulatory programs. Implementing recognized industry practices in the use of MOCA in castable polyurethane processing can assist PMA members to control the potential for employee exposure, prevent or control releases and emissions, and comply with a broad range of health and safety requirements related to the use of MOCA.

Although specific circumstances vary from processor to processor, the following

summarizes employee exposure considerations and environmental compliance issues generally applicable to the use of MOCA in the castable urethane industry. State-specific requirements (such as controlled work areas and periodic air monitoring) may also apply.[1]

A. Summary of Employee Exposure Considerations

The use of a closed transfer system such as vacuum transfer system or contained gravity feed system, in transferring the MOCA from the MOCA shipping drum to a melter or dispenser minimizes potential for MOCA workplace contamination. Low-dusting forms of MOCA should be used to minimize the potential for surface contamination, skin contact, and inhalation.

The use of properly selected chemical-resistant gloves and long-sleeved front-closing smock is generally indicated as a precaution against potential skin contact with MOCA. Companies will need to conduct a personal protective equipment (PPE) assessment as required by OSHA regulation (1910.132). Gloves and other PPE need to be selected based on the specifics of the work being performed, including the other chemicals being used with MOCA. For example, separate PPE assessments may be needed for machine casting, hand casting, maintenance, mix head cleaning, and melting tank cleaning.

Periodic MOCA urinalysis, along with prompt follow-up testing of workers with higher MOCA in urine levels (including observations of their specific work practices) is an essential element of worker exposure verification. The use of MOCA urinalysis monitoring helps verify the effectiveness of the processing equipment, protective clothing and work practices used to avoid MOCA employee exposure.

Cleaning solutions used periodically to decontaminate work surfaces subject to MOCA contamination and general area cleaning practices control workplace surface contamination. Vacuum cleaners equipped with HEPA filters are effective for removing MOCA particles in housekeeping and in the event of spill.

Wipe sampling provides information regarding status of surface contamination with MOCA in the workplace and can be useful to augment urinalysis monitoring. Although, wipe sampling results reflect the potential for employee exposure, actual exposure depends on the use of protective gloves, other task-specific PPE, and other risk mitigation activities. Levels of contamination can also vary through the work cycle where decontamination procedures are used.

Documentation of employee training concerning MOCA and training in work procedures should be retained in each employee's personnel file. Monitoring results should also be retained. No medical surveillance for MOCA exposure is indicated.

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[1] Note that this MOCA Use Guidance document addresses federal safety, health, and environmental regulations applicable to MOCA, and does not evaluate the regulations of each of the states. Individual states often adopt, in large measure, the federal environmental framework as the state regulations; however, some states have promulgated more strict regulations. Therefore, compliance with a federal regulation relating to MOCA does not necessarily constitute full compliance with all relevant and applicable state and local regulations. As a result of the differences that can arise between the application of federal and state regulations concerning the use of MOCA in a specific workplace, it is absolutely essential that each processor using MOCA ascertain to what extent, if any, the state regulations relevant to the use of MOCA differ from federal regulations. For assistance in identifying the regulations applicable to the use of MOCA in your state, upon inquiry to the PMA office, assistance can be provided to PMA members through a consultation service with the PMA regulatory consultants.

The following sections present discussions of such health and safety issues as air contaminant levels (Section 3.0), recommended workplace practices (Section 4.0), exposure training (Section 5.0), and medical surveillance (Section 6.0).

3.0 OSHA AIR CONTAMINANT ISSUES

A. Former OSHA Standards

At present, OSHA does not have in effect federally an air contaminant standard specifically regulating MOCA. Formerly, in January 1989, OSHA had included MOCA in its amendment to its Air Contaminant Standard § 1900.1000 and regulated the chemical to the time weighted average limit for an 8-hour period of 0.02 ppm or 0.22 mg/m^3 with a skin notation. The U.S. Court of Appeals, Eleventh Circuit vacated the air contaminant amendment in July 1992, and OSHA formally withdrew its regulation in June 1993. This specific OSHA regulation is therefore no longer in effect, and there is currently no federal OSHA air contaminant standard for MOCA.

OSHA previously announced that one of the agency's objectives is to re-establish the vacated air contaminant amendments, and since there was no controversy regarding the MOCA regulation, it is reasonable to expect that the air contaminant regulation for MOCA could be reinstituted in the future as a federal standard. Most states will likely adopt any such standard. The PMA regards the air contaminant standard that had been established by OSHA in the vacated regulation for MOCA to be a reasonable standard and recommends that the castable polyurethane industry continue to view the standard as an industry guideline.

Some states have adopted legislation authorizing the respective state agency responsible for occupational safety and health to adopt workplace safety standards that are more broad and stricter than the federal standards. To date, California, Kentucky, and Oregon are the only states which have, independent of federal OSHA, developed and promulgated a workplace standard for MOCA that is presently in effect.

Note also that some states adopted the proposed federal OSHA standard for MOCA promulgated in 1974, even though that federal OSHA standard was subsequently vacated by a federal court, several states retain the regulation as the workplace standard. While a few states (e.g., California, Oregon, and Kentucky) actively enforce their state MOCA regulations, some other states have MOCA regulations but have not actively enforced them.

It is therefore important that each polyurethane processor determine the status of state regulations applicable to MOCA. Observing the recommendations contained in this Guidance will very likely result in compliance with state requirements, but some state regulations, such as those promulgated in California, Oregon, and Kentucky, may require additional actions by the processor.

B. An Industry Guideline

MOCA can be readily used in castable polyurethane processing without exceeding these limits if controls are properly used and maintained. The results of air monitoring performed in castable polyurethane workplaces which utilize control procedures, equipment, and strategies described in this Guidance have routinely documented no detection of MOCA.

Detectable MOCA vapor is extremely unusual when the chemical is in either liquid or

pellet form in the workplace because of the chemical's low vapor pressure of 10^{-9} mm Hg. at 70°F in the solid state and 10^{-5} mm Hg at 240°F in the liquid state.

Control of MOCA particulate contamination has been significantly enhanced with the change by MOCA manufacturers in the 1980s to a glazed pellet, which reduced the potential for MOCA dust particles as compared to the former prilled product. Also, improved methods for transfer of MOCA from the shipping container to the melter were developed in the 1970s and 1980s.

4.0 RECOMMENDED WORKPLACE PRACTICES

A. MOCA: Engineering Controls

Engineering controls are equipment or changes to equipment which reduce the potential of being exposed to a hazard. If there are engineering controls, ensure that they are being used, properly maintained, and are working properly.

Some examples of engineering controls are the following.

- Use of glazed pellets to minimize dust.
- Hoods/enclosures draw dust/vapors away from the employee.
- Closed transfer systems (e.g., vacuum transfer system, controlled gravity system).
- HEPA filters on vents capture MOCA dust to prevent it from going into the atmosphere.
- Proper melting and processing temperatures ensure MOCA is not overheated.
- If stored properly, MOCA presents no known hazard.
- MOCA has been shown to produce no signs of gas generation or exothermic decomposition for up to 48 hours at 250°F (121°C). This is usually a satisfactory temperature for machine processing with MOCA.
- A temperature of 285°F (140°C) should be considered a maximum operating limit.
- MOCA will decompose when heated to excessive temperatures, giving off gaseous by products that can generate high pressure in closed vessels. Once this decomposition reaction occurs, it is exothermic (generates heat) and becomes self-sustaining. These gaseous by products are irritating and may be hazardous. Also, the pressure buildup may present an explosion hazard. The decomposition reaction is initiated at approximately 204.4°C (400°F).

The following controls are recommended when using MOCA in closed vessels:

- Interlock to shut off heating system,
- Pressure relief system to direct by products away from all personnel (e.g., outside),

- Have operators periodically monitor the machine temperature.

Good manufacturing process controls can be utilized to maintain the residual MOCA concentration in the finished product to below 0.1%.

Good manufacturing process control can include:

- Proper process quality control parameters for production (including stoichiometric ratio, process temperatures, time at temperature, post cure time and temperatures, etc.)
- Calibration of all gauges, test equipment, including weight scales, pressure and vacuum gauges, thermometers (thermocouples, contact and infrared), manometers and air flow velocity instruments, mechanical properties testing equipment, chemical lab equipment, etc., with calibration typically performed on a yearly cycle.
- Daily ratio checks (cup shots) of processing machines that do not have closed loop mass flowmeter control. Weekly ratio checks if there is flowmeter control.
- Daily checks of processing machine parameters, vacuum, heat, pressures, etc.
- Routine checks of mechanical properties to verify the processes are yielding the expected results. (This is an "after the fact" testing, but with history)
- Preventative maintenance of safety and environmental equipment such as cold traps, filters, etc. (frequency as appropriate).
- Daily verifications of oven temperatures, minimum yearly calibration.
- Monthly hood and other local exhaust ventilation air velocity measurement.

B. Process Monitoring and Quality Control

i. Residual MOCA levels in Finished Products

The amount of unreacted MOCA contained in a finished part can be important. Safety implications are not of great concern due to residual MOCA content. With proper formulation, curing and post-cure, residual MOCA content in products is anticipated to be low enough not to pose an overexposure risk due to activities such as handling, grinding, sanding, and trimming.

The importance of residual MOCA levels is most often seen in its regulatory implications since it is classified as a "carcinogen". Many regulations, such as REACH, have a trigger level. If the concentration of the chemical of interest is under that level, the regulatory burden is reduced or even disappears. REACH and many other regulations use a level of 0.10 weight %, so it benefits a processor to operate in such a way as to be confident that their parts have under 0.10% residual MOCA. Given the variation that occurs in all processes, you would want to typically be well below this level to be able to have reasonable expectations that you will always be below it when the process is well controlled even with the inherent variations in materials and processes.

The Effect of Processing Variables on Residual MOCA Levels

Research performed under the auspices of the PMA and others have demonstrated that residual MOCA levels are affected by the prepolymer type, stoichiometry, and post cure conditions.

Polyurethane Processing

Cast thermoset Polyurethane is made by mixing together the ingredient chemicals (typically a diisocyanate prepolymer and a chain extender) in predetermined proportions, which then react to form the polymer.

The production of consistent end products depends on mixing, in precise ratio, the ingredient chemicals and maintenance of the appropriate processing temperatures. Other ingredients can be included, for example a catalyst to control the rate at which the liquid mixture reacts to become solid, colorants, plasticizers, and others.

As the liquid prepolymer and extender react to form the PU, the liquid mix becomes increasingly viscous, eventually forming a solid mass. After demolding the part typically undergoes heated post-curing to accelerate the final cure.

Polyurethane Chemistry

The first step in prepolymer chemistry is to produce a precursor to the final product by reacting to a polyol component with an excess of an isocyanate component. This results in what is known as an isocyanate-terminated prepolymer. The ratio of the reactive groups of the polyol and isocyanate are closely measured during this process and the resultant prepolymer has an excess of reactive isocyanate left over. These reactive isocyanate groups that remain are measured as "% NCO". This % NCO is used in stoichiometry calculations.

Stoichiometry calculations are used by processors to determine the correct amount of reactive components to be used in the manufacturing process. The ratio of the number of curative (MOCA) reactive amine groups to the number of isocyanate prepolymer reactive groups is known as the "stoichiometry". In general, the number of reactive groups present in the two components must be nearly equal in order to produce an end-product which possesses acceptable physical and mechanical properties. Typically, when reacting with polyurethane components, the stoichiometry is targeted at 0.95. However, depending on the desired end results, the stoichiometry can be varied over a range of 0.90 to 1.02 and maintain residual unreacted MOCA levels significantly below 0.10 weight percent.

ii. Manufacturing

The methods of manufacturing polyurethane finished goods range from small, hand pour piece-part operations to large, high-volume computer-controlled casting machine production lines.

Regardless of the end-product, the manufacturing principle is the same: to meter the liquid components at a specified stoichiometric ratio, mix them together until a homogeneous blend is obtained, dispense the reacting liquid into a mold or on to a surface, wait until it cures, then demold the finished part and let it cure.

iii. Dispensing equipment

Although the capital outlay can be high, it is desirable to use a closed loop controlled, closed material transfer dispensing unit for even low-volume production operations that require a steady output of finished parts.

Dispense equipment consists of material holding (day) tanks, metering pumps, a mix head, and a control unit. Material day tanks may be supplied directly from drums, IBCs (intermediate bulk containers, such as totes), or bulk storage tanks. Pumps can be sized to meter in single grams per second up to hundreds of pounds per minute. They can be rotary, gear, or piston pumps. Control units may have basic on/off and dispense/stop switches, and analogue pressure and temperature gauges, or may be computer-controlled with flow meters to electronically calibrate mix ratio, digital temperature and level sensors, and a full suite of statistical process control software. Less sophisticated dispensing machines and even hand batching can be successfully used if appropriate care is taken.

iv. Process Control

Effective process control will lead to consistent products with a predictable, consistent amount of residual MOCA. Following are some considerations in controlling process variables that can affect the final product including the residual MOCA level.

v. Raw Materials

A manufacture's certificate of analysis indicating the NCO% should be received for each lot of isocyanate (prepolymer) since the NCO% is what is used to determine the required amount of curative and there typically is lot to lot variation.

vi. Storing, Conveying, Melting and Heat History

The reactivity of Isocyanates (prepolymers) will change over time based on storage conditions and exposure to moisture and heat. MOCA can also degrade if storage/handling guidelines are not followed.

- Follow storage and shelf-life recommendations, keeping containers sealed when not in use.

- Use a closed system, if possible, for conveying material. Fix leaks anywhere in the process to avoid moisture intrusion. Use a dry nitrogen blanket or equivalent where appropriate. Minimize ambient air exposure in open systems. If drawing from a drum, install a desiccator cartridge on the bung. Consistent, even heating of the entire system (drums heaters, lines, tanks, degassers, pumps, mixers, etc.) will avoid overheating and lead to a more stable NCO%. Closed loop controls are best.

- If there is a concern that NCO% has been affected, a titration test can be performed to determine the current NCO% level.

vii. Metering

To maintain the desired ratio, closed loop flow control using mass flowmeters is the best. Calibrate the meters per manufacturer's recommendations. Calibrations can be expensive and are often performed yearly. However, since the ratio is crucial to final part properties and performance, verification of the flowmeter's readings should be performed periodically by taking cup shots. Cup shots are the comparison of the weights of equally timed shots of the prepolymer and curative outputs. A weekly verification can be appropriate, but as always you need to understand the needs and risks involved in your own process and adjust the frequency of tests and the rigor of controls appropriately.

viii. Mixing

With the pump/metering system delivering the correct proportion of materials to the mixer, make sure the lines and mixer aren't causing problems such as leaks or other maintenance issues.

ix. Determinants of Residual MOCA Levels

Various studies have demonstrated that residual MOCA levels are affected by the prepolymer type, stoichiometry, and post cure conditions. Although there is a large variety of prepolymers available, many of them fall into a few broad categories, and it is reasonable to assume that similar types will process similarly. Here are residual unreacted MOCA results from an EHS Analytics study sponsored by the PMA which used the following elastomer processing conditions:

Prepolymer Temperature	180°F (85°C)
MOCA Temperature	230-250°F (110-121°C)
Mold Temperature	212°F (100°C)
Post Cure Temperature	212°F (100°C)
Post Cure Time	16 hours

The weight % residual unreacted MOCA in the elastomers using the processing conditions above were determined via extraction with acetone and are reported in the table below:

Composition	Stoic.	MOCA (% w/w)
75D Conventional TDI/PTMEG/MOCA	0.90	0.000130
75D Conventional TDI/PTMEG/MOCA	0.90	0.000150
70D Conventional TDI/Polyester/MOCA	0.90	0.000067
75D Conventional TDI/PPG/MOCA	0.90	0.000310

75D Low Free TDI/PTMEG/MOCA	1.02	0.00130
75D Low Free TDI/PTMEG/MOCA	1.02	0.00150
75D Low Free TDI/Polyester/MOCA	1.02	0.00710
75D Low Free TDI/PPG/MOCA	1.02	0.00350

x. TDI Prepolymer Type

High hardness TDI prepolymer systems were used to provide a worst-case scenario for the residual unreacted MOCA level. The residual unreacted MOCA results indicate that there is no significant effect of the TDI prepolymer backbone which results ranging from 0.000067 to 0.000310 at a 0.90 stoichiometry to 0.00130 to 0.00710 at a 1.02 stoichiometry.

xi. Stoichiometry

Increasing the stoichiometry from 0.90 to 1.02 increased the residual unreacted MOCA by about 10 times. Even at a stoichiometry of 1.02, the residual unreacted MOCA level was at least 14 times lower than the 0.10 weight % limit.

xii. General Processing Guidelines for TDI Prepolymers

General guidance for TDI prepolymer systems regarding processing conditions to achieve residual unreacted MOCA levels below 0.10 weight % are:

Stoichiometry:	0.90 to 1.05
Mold Temperature:	180 to 230 F
Post Cure Temperature:	180 to 230 F
Post Cure Time:	≥12 hours

xiii. Hydrogenated MDI/PTMEG Prepolymer

A high hardness H_{12}MDI prepolymer system was used to provide a worst-case scenario for the residual unreacted MOCA level. Using the same processing conditions, a high hardness 75D H_{12}MDI/PTMEG was reacted with MOCA at a stoichiometry of 1.02. The acetone extraction of this elastomer resulted in a residual unreacted MOCA content of 0.0050 weight percent which is 20 times lower than the 0.10 weight % limit.

xiv. General Processing Guidelines for Hydrogenated MDI Prepolymers

General guidance for TDI prepolymer systems regarding processing conditions to achieve residual unreacted MOCA levels below 0.10 weight % are:

Stoichiometry:	0.90 to 1.05

Mold Temperature:	180 to 230 F
Post Cure Temperature:	180 to 230 F
Post Cure Time:	≥16 hours

C. Control of MOCA contamination during the transfer of MOCA pellets from the drum to the melting stage

Use of closed transfer procedures controls potential workplace contamination during transfer of the MOCA pellets from the drum to a MOCA melter. Where MOCA is used in the manufacture of relatively small products and parts, often utilizing a "hand-casting" procedure, a closed transfer method can be used to transfer the MOCA pellets from the drum to a dispenser for weighing and melting small quantities of the chemical. MOCA melter machines are available that dispense weighed/measured amounts of liquid MOCA suitable for hand-casting operations.

Two principal closed transfer systems include vacuum transfer systems, which are commercially available, or gravity feed systems in conjunction with MOCA shipping drums which incorporate a spout dispenser as a part of the blow mold inner liner in the drum.

Manual transfer of MOCA from the shipping drum to a melter in an enclosed MOCA transfer area, with reliance upon personal protective equipment and clothing to avoid employee exposure, or glove boxes, have also been used to control employee exposure. Note gloves in glove boxes can become contaminated and can become an important source of skin exposure.

D. Air monitoring to determine workplace MOCA contamination during the use of MOCA in the processing operation

Closed transfer systems readily control MOCA air contamination and achieve compliance with the previous OSHA air contaminant standard. During 1988, the PMA sponsored MOCA air contaminant testing at three typical processor operations. One processor used a vacuum system to transfer MOCA pellets from the drum to a melter in an automatic machine mixing operation. Another used a vacuum system to transfer MOCA from the drum to a gravity-feed container located in a negative pressure hood for subsequent MOCA weighing and melting for "hand-casting". A third used a gravity feed transfer system by permitting MOCA pellets to flow from the drum through the drum blow mold inner liner spout to a melter. The air monitoring results in all three operations demonstrated compliance with the OSHA MOCA standard. MOCA was undetectable in these situations, except a trace detection of MOCA air contamination in one sample. These results were consistent with previous MOCA air monitoring results observed in other workplaces. More recently published exposure studies found that over 80% of samples had nondetectable levels in air. The highest MOCA exposures occurred when workers were pouring mixed liquid polyurethane into molds without any exhaust ventilation.

MOCA air monitoring by the processor using a closed transfer system is not necessary to comply with the former Federal OSHA standards where a program of employee urinalysis is followed. However, initial employee breathing zone air sampling provides baseline information and demonstrates that the previous OSHA levels are met. If a closed transfer

system is not utilized, an initial air monitoring would appear desirable to assure that the MOCA transfer procedure utilized does not result in employee breathing zone air contaminant levels in excess of the former federal OSHA limits. In the event of significant modifications to the MOCA transfer system, it is recommended that air monitoring be conducted again, particularly where a closed system is not utilized. Air pumps for employee breathing zone monitoring is available on a rental basis and proper sampling and lab analysis can be coordinated with Kay Rowntree, CIH Industrial Hygiene Sciences, LLC., kayihs@tds.net 262-534-2554.

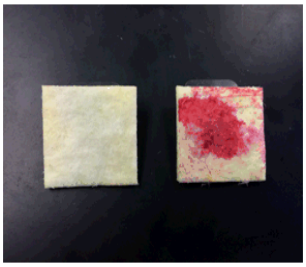
E. Use of respirators by employees and provision for workplace ventilation

Employees working in MOCA areas customarily are not required to use respirators, since the recommended exposure levels are not exceeded. However, processors may, for certain operations in castable polyurethane processing, desire to instruct employees to use respirators even though the air concentrations of MOCA are not expected to exceed the recommended levels. Such use may be prescribed as an added precaution to avoid MOCA exposure, particularly in activities or operations involving a potential for exposure to accumulated MOCA particulates, such as equipment maintenance or clean-up of a MOCA spill. Internal surfaces of exhaust ducts can become contaminated with MOCA and can be a source of employee skin exposure during HVAC maintenance activities.

Where respirators are used, such use must comply with provision of the OSHA respiratory protection standard 29 CFR 1910.134. For example, the appropriate type of respirator must be selected and used, it must be properly maintained, and employees must be fit tested, medically qualified, and trained in its use.

F. Surface Testing

- SKC SWYPES™ can detect MOCA and other aromatic diamines.
    - Wear chemically resistant gloves and safety goggles. Lightly spray area to be tested with Cleaning Solution. Wait at least 30 seconds and then wipe with a Surface SWYPE™ pad. Allow 3 minutes for a color change reaction to occur. The sensitivity of the SWYPE™ is as low as 3-5 µg for aromatic amines.
        - ➢ The Surface SWYPE™ on the right shows MOCA contamination (red color change).



    - Detection of MOCA does not necessarily mean someone has been exposed due to use of PPE, hygiene, and engineering controls.

G. Potential for employee MOCA exposure by skin contact with contaminated surfaces

There is currently no Federal surface contamination criteria or quantifications for MOCA skin absorption. However, other jurisdictions have surface contamination criteria. The state of California mandates surface sampling as part of their requirements for maintaining controlled access areas. These requirements include:

(1) All areas outside of controlled access areas shall be maintained so that MBOCA contamination of surfaces does not exceed 100 ug per 100 cm^2.

(2) All equipment and materials removed from a controlled access area shall be decontaminated so that MBOCA does not exceed 100 ug per 100 cm^2 of surface.

(3) Entry to controlled access areas shall be limited to authorized personnel and escorted visitors. A daily roster shall be made of persons who enter the controlled access area.

(4) Storage, consumption or use of food, beverages, cosmetics, smoking or chewing materials are prohibited in controlled access areas, except for foot-operated drinking fountains.

Experience has demonstrated that skin contact is an important and primary route for employee exposure to MOCA in castable polyurethane operations. Experience has further demonstrated that MOCA particles can be present on some workplace surfaces. However, regulators have acknowledged that surface contamination in itself does not constitute an employee exposure. This is where urinalysis testing is helpful.

Surface monitoring results do not quantify likelihood that employee exposure may occur, but surface monitoring can help identify where skin exposures might occur. Surface monitoring can also help to identify work practices that may affect MOCA surface accumulations and assist in identifying effective work practices and housekeeping. Engineering controls, personal protective clothing, employee work practices and housekeeping practices are routinely used by processors to successfully avoid workers' skin contact with MOCA.

It is advisable that a processor develops and retains information which establishes that employee exposure is adequately controlled, particularly where wipe tests establish the presence and/or non-detection of MOCA surface contamination. Such information will substantially assist in avoiding an erroneous or arbitrary exercise of discretion by a compliance officer. The employer's use of urinalysis monitoring is also recommended in this regard.

H. Use of MOCA Exposure urinalysis monitoring.

A MOCA urinalysis testing program is recommended for those employees who work in areas of potential MOCA exposure, including areas where MOCA surface contamination is expected. Such a monitoring program will demonstrate that the protective equipment, protective clothing, and work practices in a specific workplace provide effective control of employee exposure, including potential exposure through contact with contaminated surfaces.[2] Utilization of

[2] MOCA urinalysis monitoring has been utilized by castable urethane processors to evaluate the effectiveness of controlling employee exposure since the 1970's. The PMA's legal counsel has over 50 years of urinalysis data from over 18 long time uses of the urinalysis program. EPA and NIOSH have endorsed the use of urinalysis monitoring by

a MOCA urinalysis monitoring system provides an additional benefit in relation to establishing compliance with OSHA requirements. Urinalysis monitoring provides an effective method to establish that MOCA surface contamination in the workplace is not "of such a nature and exist in such quantities as to pose a serious hazard". It establishes that the protective clothing or other protective means such as controls used in the workplace effectively control employee exposure to MOCA. Establishing that the controls used in the workplace effectively control employee exposure to MOCA should avoid an unreasonable or arbitrary exercise of discretion by a regulatory inspection officer.

Thus, urinalysis results verify whether the protective clothing, processing equipment, and procedures utilized by a processor effectively control employee exposure by skin or dermal absorption or ingestion. Without such factual information, an enforcement officer's discretionary judgment might lead to an erroneous or unreasonable citation.

I. Implementing Urinalysis Testing Programs

The following is a typical scenario that is followed when starting a MOCA urinalysis program. It is presented as an example and may need to be modified based on your judgement of the needs of your particular situation

When starting a urinalysis program, consider casting a wide net. MOCA contamination could be tracked into lunchrooms, locker rooms, on a person’s clothing, in their car, outside areas of casting hood exhaust or other common areas, potentially exposing people that do not directly work with MOCA.

The goal is to search the facility for exposures based on relative risk. Not every employee in every role at a facility needs to be tested for MOCA exposure. Instead, exposure testing volume should be based on the relative exposure risk faced by each type of employee at the facility.

In practice a relative risk-based testing program would consist of testing all employees who are at a high risk of MOCA exposure, testing a thorough (but not necessarily complete) sample of

processors. OSHA has used MOCA urinalysis monitoring as part of enforcement inspections to evaluate employee exposure to the chemical. The State of California in 1979 adopted a MOCA health standard setting 100 ug of MOCA per Liter of urine as the maximum permissible employee exposure to MOCA. In the 1970s, Health Evaluations Program developed a MOCA urinalysis monitoring program in cooperation with the PMA. This urinalysis monitoring program is presently available from SKC Inc, 863 Valley View Rd, Eighty-Four, PA 15330, 800-752-8472. The CLI analysis procedure was evaluated by NIOSH in 1985 and determined to provide an acceptable methodology. The castable urethane industry has informally applied the California standard of I00 ug/L as representing a reasonable, maximum acceptable exposure value. Processors generally experience employee urinalysis results of undetectable to less than 50 ug/L, with only occasional excursions, for any given employee over 50 ug/L. Less than 1% of the employee samples have exceeded 100 ug/L, and then only rarely has such an exceedance been repeated for any given employee. An historical analysis of the PMA's urinalysis monitoring program was published by L.K. Lowry and D.E. Clapp in Applied Occupational and Environmental Hygiene, September, 1992. Copies of the article and information regarding this program can be obtained from the PMA. Urinalysis results which are undetectable support a compliance officer's determination that the processor's controls are adequate. Urinalysis results involving detectable MOCA under 100 ug/L, based upon the industry's recognition of the California MOCA standard, would also support a determination that the exposure does not constitute a serious hazard. If a citation were issued, urinalysis results under the 100 ug/L recognized by the California standard will place the processor in a strong position to challenge the citation. In previous OSHA general duty citations against processors during the late 1970s, compliance with the California exposure standard, as expressed by the 100 ug/L MOCA urinalysis limitation, has been determined by OSHA administrative law judges not to violate the general duty clause.

all employees who are at medium risk, and testing of a smaller yet sample of those at low risk. The low-risk category should include some employees that wouldn't be obviously expected to be exposed to MOCA, such as office personnel and other employees who spend little time in the plant itself. Urinalysis samples should be collected at the end of the work shift.

Once you have this screening done, carry out any needed improvements/corrective actions and re-test to determine the effectiveness of the corrective actions. Improvements must continue until all employees are at an acceptable level of exposure. Newly updated processes should be developed to avoid exposure increases, but ideally the newly updated processes would reduce exposure.

In the meantime, Training (e.g. Haz. Comm.), housekeeping, equipment maintenance, etc. are to be continued to at least maintain, if not reduce, exposure while new processes and procedures are developed.

Once your situation is stable, i.e. all employees are at an acceptable exposure level, the frequency of future urinalysis testing should be based on the risk of exposure and historical experience. Quarterly urinalysis testing may be appropriate in an area/task that has high exposure potential or has previously experienced higher urinalysis test results indicating higher MOCA exposures. For areas/tasks with lower exposure potential or low/non-detect urinalysis readings, biannual or annual testing may be appropriate. Little or no risk areas that have historically had only non-detects under the facilities' current exposure control program might test even less frequently, if at all. As an example, if there is a history of test results for a given task that is below a low level (such as 20 µg MOCA/L urine), the frequency of testing may be reduced.

Some tasks that potentially could have a higher potential for exposure may include but are not limited to pouring, demolding, finishing, material handling (open systems) and maintenance persons and their tools.

Some tasks that potentially could have a medium risk of exposure may include but are not limited to material handling (closed systems) and working in areas adjacent to areas where MOCA is used or handled.

Tasks with low potential of exposure may include but are not limited to employees who are not frequently around areas where MOCA is used or handled, including office workers.

Different types of controls (engineering, PPE, and administrative) for a given task should be used to minimize the potential for exposure. Lowering the risk of exposure may enable a reduction of test frequency.

Facilities should maintain exposure levels below 100µg MOCA/L which is the limit set by California in 1979. The goal should be to lower exposure levels over time with the ultimate goal of consistently achieving non-detectables. Note: SKC reports anything less than 15µg MOCA/L urine as non-detectable.

- **If at or above 100µg/L or actionable level set by the facility, perform the following actions.**
    - Talk to worker and investigate work practices on the day of the test, including raw material container decontamination and disposal, minimizing dust, regular cleaning of surface areas.

- Review common and frequent routines such as break and lunch areas.
- Review use of PPE, frequency of change out and proper disposal.
- Take necessary actions which could include cleaning/decontamination of the area, tools, equipment maintenance, and retraining/changing work practices.
- Retest worker to confirm that level has dropped.

Initially, quarterly urinalysis testing may be appropriate in an area/task that has high exposure potential or has previously experienced higher urinalysis test results indicating higher MOCA exposures. For areas/tasks with lower exposure potential or low/non-detect urinalysis readings, biannual or annual testing may be appropriate. Low or no risk areas that have historically had only non-detect results may have infrequent testing, if at all.

Different types of controls (Engineering, Administrative, and PPE) may be used to minimize the potential for exposure. Lowering the risk of exposure may enable a reduction of test frequency. If there is a history of test results for a given task that is below a low level (e.g., ≤ 20 µg/L urine), the frequency of testing may be reduced.

J. Use of personal protective clothing

Employee protective clothing should be used as necessary to establish an effective barrier between the employee and potentially contaminated touch surfaces.

The adequacy of the protective clothing for a specific operation is effectively evaluated by urinalysis monitoring results. Any unusual processing techniques or procedures may require additional clothing and PPE on a regular or special work task basis.

Studies of MOCA use in U.K. casting shops found in increase between urinary MOCA levels and the extent of glove contamination (for both heat-resistant fabric gloves and/or chemical- resistant glove liners). Higher MOCA levels were also correlated with individual work practices, including improper glove removal practices (Keen, 2012).

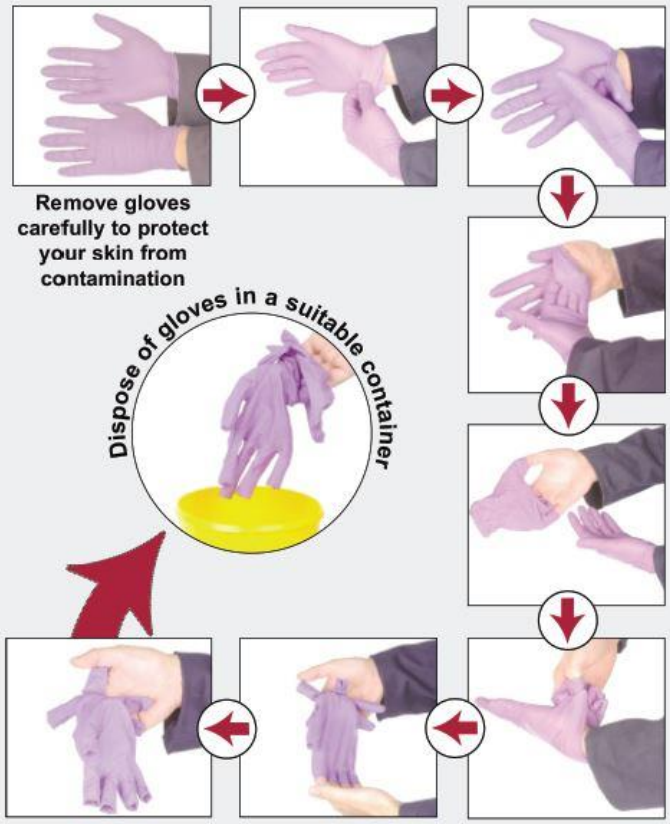
HSE

Health and Safety Executive

Correct removal of gloves

Single use gloves (splash resistant)

Follow the steps shown



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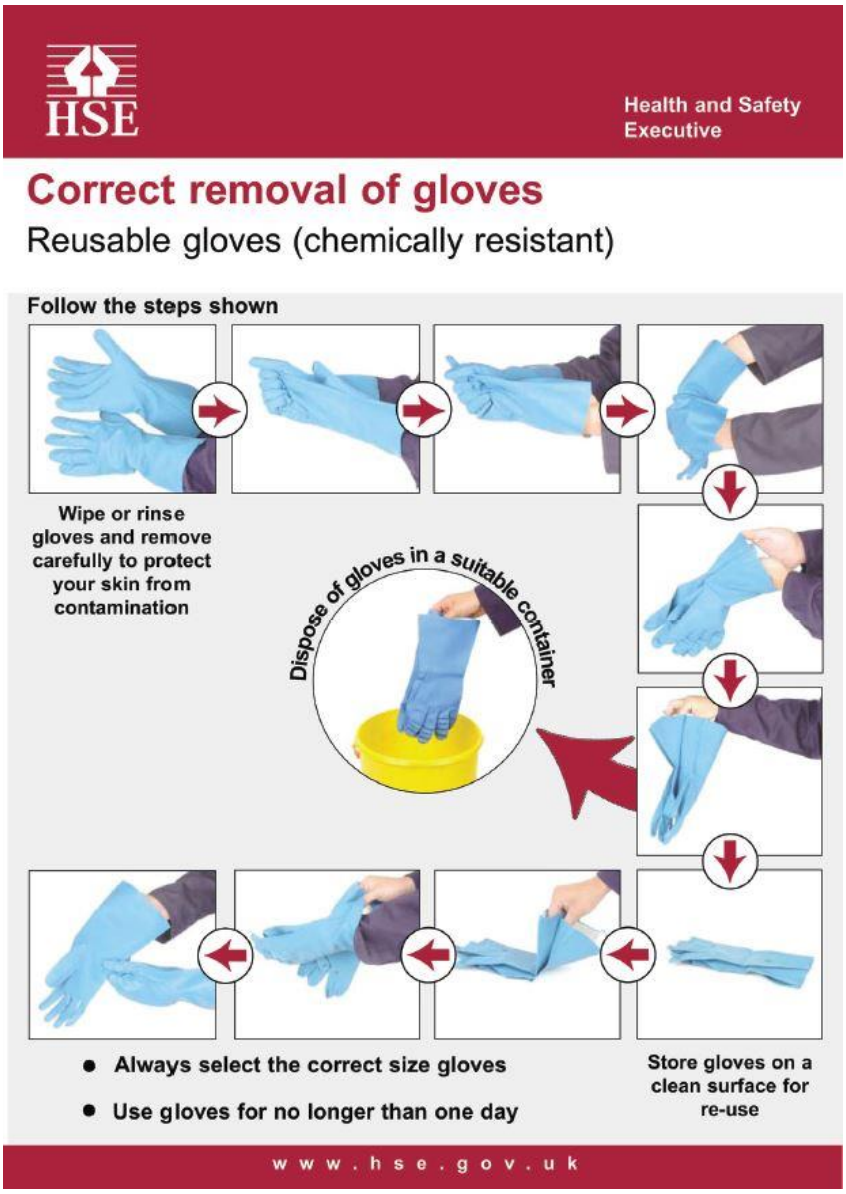


Some casting shops for selected tasks wear thin disposable gloves for splash protection instead of immersion protection barrier gloves. Splash gloves are changed frequently, at a minimum between tasks with high potential for skin contact, and also whenever the splash gloves become visibly contaminated on their surface. These practices have been demonstrated in shops as an effective way to minimize MOCA urinalysis levels in their shops.

K. Personal Protective Equipment (PPE)

- It is important to determine the Personal Protective Equipment (PPE) required for a task. PPE should be appropriate for the potential exposure.
- Minimum PPE when handling MOCA with closed systems: (this includes automated filling/melting/dispensing systems where exposure potential is more limited.

- Safety glasses with side shields.
- Chemical resistant gloves.
    - Change the chemical resistant gloves on a regular basis.
- For handling hot objects, consider heat resistant gloves.
    - Chemically resistant gloves under heat resistant gloves are recommended.
- Minimum PPE when handling MOCA with open systems with a higher potential for exposure.
    - Long sleeved shirts and long pants
    - Safety glasses with side shields.
    - Chemical resistant gloves.
        - Change the chemical resistant gloves on a regular basis.
    - For handling hot objects, consider heat resistant gloves.
    - Chemically resistant gloves under heat resistant gloves are recommended.

- Other PPE for specific exposure scenarios.
    - For likely body exposure, consider long sleeved smock or impervious coverall (e.g., Tyvek™)
    - Under normal conditions, for potential inhalation above exposure limit, consider particulate air purifying respirator. Under abnormal conditions (including emergencies) an organic vapor air purifying respirator or supplied air respirator may be needed.
        - If respirator is used, ensure compliance with the OSHA Standard 29 CFR § 1910.134.
    - Consider shoe covers to prevent spreading contamination to other areas and to avoid dermal exposure when removing footwear.
    - For likely head exposure, consider hooded impervious coverall.
- Other considerations.
    - Do not contaminate other areas with contaminated PPE.
    - Remove potentially contaminated PPE before leaving work area.
    - Do not touch your skin or clothing with contaminated gloves.
    - Consult regulations (Federal, State, Provincial and Local) regarding proper selection and use of PPE.

L. Surface Cleaning and Decontamination

- HEPA (High Efficiency Particulate Air) filtered vacuum cleaner can be used for cleaning MOCA. Do not use a standard vacuum cleaner, compressed air or dry broom sweeping since that could spread the contamination.
- SKC Cleaning and Decontamination method for MOCA.
    - Perform this operation in a well-ventilated area and wear chemically resistant gloves and safety goggles.
    - Wet area completely with Cleaning Solution. Use an abrasive pad if needed to enhance penetration. Spray area with DECONtamination Solution and allow to react for at least 5 minutes. Rinse area with water. Check the area with the Surface SWYPE™ test method to confirm decontamination is complete.
- The following procedure could be used for large MOCA spills.
    - Perform this operation in a well-ventilated area and wear chemically resistant gloves, long sleeved smock, safety goggles and chemically resistant boots.
    - Wet area completely with SKC Cleaning Solution. Spray area with SKC DECONtamination Solution and allow to react for at least 5 minutes.
    - Use broom and dustpan to collect the wet decontaminated material and place material in proper waste container.
        - Do not use a broom and dustpan to collect dry MOCA due to potential to spread contamination.
    - Rinse area with water. Check the area with the Surface SWYPE™ test method to confirm decontamination is complete.

5.0 WORKPLACE EXPOSURE TRAINING

Each polyurethane processor is required to provide employee training consistent with various safety, health, and environmental programs. These requirements include training under OSHA's Hazard Communication Standard ("HAZCOM"), codified at 29 CFR 1910.1200; OSHA's Hazardous Waste Operations and Emergency Response Regulations, 29 CFR 190.120; the EPA Hazardous Waste Operations and Emergency Response regulations, 40 CFR 311.1; and the DOT Training for Safe Transportation of Hazardous Materials. Separate training requirements may be applicable under various environmental programs, to be discussed later in this Guidance.

As employers, polyurethane processors are required, pursuant to 29 CFR §1910.1200, the OSHA Hazard Communication regulation, to develop and maintain a written hazard communicated program. This program requirement applies to the use of MOCA, which is one of many industrial chemicals identified as a hazardous substance. The hazard communication program must include comprehensive information about MOCA, the health hazard associated

with MOCA exposure, and training of the employees in the use of the chemical in the workplace.

The 2012 revision of the HAZCOM made significant changes to the old standard, and the details of the current standard will not be covered in detail. The OSHA Small Entity Compliance Guide for Employers That Use Hazardous Chemicals (OSHA 3695-03 2014) identify these steps towards HAZCOM compliance

- Obtain a copy of OSHA's Hazard Communication Standard.
    - Become familiar with its provisions.
    - Make sure that someone has primary responsibility for coordinating implementation.
    - Identify staff for particular activities (e.g., training).
- Prepare and Implement a Written Hazard Communication Program
    - Ensure Containers are Labeled
    - Prepare a written plan to indicate how hazard communication will be addressed in your facility.
    - Prepare a list or inventory of all hazardous chemicals in the workplace.
    - Keep labels on shipped containers.
    - Label workplace containers where required.
- Maintain Safety Data Sheets
    - Maintain safety data sheets for each hazardous chemical in the workplace.
    - Ensure that safety data sheets are readily accessible to employees.
- Inform and Train Employees
    - Train employees on the hazardous chemicals in their work area before initial assignment, and when new hazards are introduced.
    - Include the requirements of the standard, hazards of chemicals, appropriate protective measures, and where and how to obtain additional information.
- Evaluate and Reassess Your Program
    - Review your hazard communication program periodically to make sure that it is still working and meeting its objectives.
    - Revise your program as appropriate to address changed conditions in the workplace (e.g., new chemicals, new hazards).

6.0 MEDICAL SURVEILLANCE

No specific employee medical surveillance relating to exposure to MOCA is indicated. No such surveillance has been identified by medical experts. There are no identifiable toxic effects from the potential levels of MOCA exposure which may be encountered in castable polyurethane casting operations. Massive overexposure to the

chemical could potentially cause cyanosis, kidney irritation, or methemoglobinemia. However, such MOCA exposure and such effects from MOCA exposure have not been reported or identified in association with the use of MOCA in castable polyurethane operations.

MOCA's status as a carcinogen is the principal health concern presented by the use of the chemical by processors. Although there is a lack of evidence in humans, the U.S. Department of Health and Human Services National Toxicology Program has determined that MOCA is reasonably anticipated to be a human carcinogen. (14th ROC). Although there is a lack of evidence in humans, MOCA is considered to be carcinogenic to humans by the International Agency for Research on Cancer (IARC MONOGRAPHS - 1OOF).

A comprehensive study performed in 1992 of employees involved in the manufacture of MOCA prior to 1978, many of whom encountered sustained exposures to the chemical during the 1950s and 1960s found no bladder cancer attributable to MOCA exposure. Since MOCA is an aromatic amine, the bladder would constitute the organ most likely to be affected if exposure to MOCA caused cancer.

APPENDIX I: ENVIRONMENTAL COMPLIANCE ISSUES FOR PROCESSORS USING MOCA

1. Summary

This section provides a brief synopsis of the key federal environmental requirements that apply to a facility using MOCA, including hazardous waste management requirements that govern the generation and management of unreacted, waste MOCA, the Superfund Amendments Reauthorization Act requiring chemical inventory and release reporting, and requirements under the Clean Air Act Amendments of 1990 regarding air emissions. These regulations are intended to control workplace exposures, protect against releases to the environment and provide for community response to any release of MOCA.

EPA and the environmental regulatory agency of the particular state may need to be notified of the use of MOCA, depending upon the processor's annual usage and the maximum amount stored at any point in time during the calendar year. An EPA identification number must be obtained by a small or large quantity generator (not required for a vey small quantity generator) before offering to ship MOCA hazardous waste for treatment or disposal.

Discarded, off-specification, container residues (if not “RCRA empty”), and spill residues of unused MOCA are regulated as a listed, RCRA hazardous waste. Such wastes may not he accumulated on-site for more than 180 days if the facility is regulated as a Small Quantity Generator of hazardous waste, or 90 days if the processor is a Large Quantity Generator. Before transportation, waste MOCA must be packaged, labeled, and placarded according to DOT regulations applicable to listed hazardous wastes, i.e., hazardous materials transportation Act enacted in 1975, Title 49 U.S.C. Sec. 5101-5127.

If the facility is regulated as Large Quantity Generator of hazardous waste, the facility must prepare an Emergency Preparedness and Prevention Plan ("Contingency Plan"). Basic planning is required for Small Quantity Generators of hazardous waste. Even if you as a small quantity generator it is advisable to have a contingency plan in case of an emergency,

or if the facility were to exceed Small Quantity Generator criteria.

In the event of a spill of 10 pounds or more of MOCA to the environment, (i.e., a release to soil, water, groundwater, or an emission to the air), the facility must notify the appropriate state and federal agencies. Some states have more stringent spill reporting requirements, and therefore a spill of less than 10 pounds may still need to be reported to the appropriate state agency.

Facilities that have on hand at any point in time during the calendar year 10,000 pounds or more of MOCA must submit the current Safety Data Sheet for MOCA to the State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC) and local fire department. In addition, they must annually submit either a SARA Section 312 Tier I or Tier II Inventory Report as required by their state. Most, if not all, states currently require a Tier II.

Special rules apply to laundering items that contain MOCA residues, such as aprons and gloves (see: Laundering regulatory compliance memorandum).

MOCA is listed as a hazardous air pollutant under the federal Clean Air Act. If the potential exists, for the generation of more than 10 tons of MOCA air emissions annually or more than 25 tons of total hazardous air pollutant emissions annually, then the facility will be deemed a major source and an operating permit will be required under the federal/state permit program, most states require minor source permits for emissions of less than 10 tons of hazardous air pollutants but greater than the state-specific threshold level. (See emissions factors from PMA round robin air emissions stack testing program report(s)) for four (4) precursor facilities in the United States.

The discussion below presents guidance for proper hazardous waste management of unreacted MOCA, laundering items that contain MOCA, complying with inventory and release reporting requirements, and understanding the Clean Air Act regulations applicable to MOCA processing.

2. Environmental Regulation of MOCA

MOCA, like hundreds of other industrial chemicals, has been designated by the EPA as a "hazardous substance" in regulations promulgated under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA", also known as "Superfund", see the table of CERCLA hazardous substances at 40 CFR 302.4).

MOCA that is disposed of, either as an off specification, expired or spilled material, or when present in wastes, is regulated as a "listed" hazardous waste in rules promulgated under the Resource Conservation and Recovery Act ("RCRA," see 40 CFR 261).

Depending on the quantities of MOCA present at a processor's facility, the polyurethane processor may be subject to hazardous chemical reporting (Tier I or Tier II inventory reporting) and Toxic Chemical Release reporting (Form A or Form R) as set forth in regulations promulgated under Title II I of the Superfund Amendments Reauthorization Act ("SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act or "EPCRA"). MOCA is also regulated under the Clean Air Act Amendment of 1990.

As a result, MOCA is subject to regulation under various EPA regulatory programs. A castable polyurethane processor is likely to use a number of chemicals classified as "hazardous"

by EPA. This document focuses solely upon MOCA; however, a processor should have prepared an integrated environmental compliance program for all hazardous substances used and all hazardous wastes generated.

The Reportable Quantity (RQ) for spill reporting of MOCA as provided at 40 CFR 302.4 is 10 pounds. For purposes of SARA Title III reporting, the Threshold Planning Quantity for MOCA is 10,000 pounds, and the Form A or R EPCRA §313 de minimis value as specified in 40 CFR 372.38 for MOCA is 1%. In other words, MOCA present in materials containing MOCA at less than 1 % is not considered for Form A or R reporting or when calculating the amount of MOCA spilled for comparison to the RQ. Some states may have more stringent spill reporting requirements.

Also, every MOCA user should review state environmental regulations to determine to what extent, if any, applicable state regulations differ from EPA requirements

3. RCRA Regulation of Waste MOCA

Normal processing results in little waste MOCA. The following are some US EPA requirements related to MOCA waste.

a. Hazardous Waste Classification of MOCA

Under the RCRA federal regulatory scheme, spilled, off specification and discarded commercially available MOCA is listed under 40 CFR 261.33(f) as "UI58". Under RCRA regulations, it is the responsibility of the polyurethane processor as the waste generator to determine when a material becomes a waste, i.e. the decision to discard. Once a material is identified as "off-spec" and no longer suitable for the purpose for which it was intended, it becomes a waste, even where the generator stores the material with the intention of eventually identifying a useful purpose for the off-spec material, a practice referred to by USEPA as "speculative accumulation."

After declaring the material to be a waste, the generator must then determine if that waste is regulated as a "hazardous waste" (**40 CFR 262.11).** To make this determination, the generator should determine the following:

i. Does the waste exhibit a hazardous characteristic as defined under the regulations (i.e., ignitability, corrosivity, reactivity, or toxicity (TCLP));

ii. Is the waste described as a waste from a non-specific or specific source (i.e., the F and K lists at 40 CFR 261.31 and 261.32);

iii. Is the waste included on the lists of discarded commercial chemical products (i.e., the U and P lists at 40 CFR 261.33(e) and (f)).

This waste determination must be made individually for each waste stream on the basis of information about the chemical nature, origin, and characteristics of that waste stream.

With regard to waste or off-spec MOCA, the waste does not exhibit the characteristics of ignitability, corrosivity, toxicity, or reactivity (as "reactivity" is defined at 40 CFR 261.23). Further, the manufacturing process in which this waste is used, and from which it is generated, is not described on the F and K lists. However, MOCA is listed as U158 on the "U list" which identifies "toxic hazardous wastes" under the RCRA program (whereas the P list designates "acutely hazardous substances").

b. Waste – Generator Requirements

According to the EPA, depending on the hazardous waste generator status of the facility, the following requirements could be applicable:

- Hazardous waste generator status determination;
- Notification of EPA and state authority and application for an EPA facility identification number;
- Compliance with recordkeeping, packaging, labeling, and manifesting of waste;
- Conduct weekly inspections of waste storage areas;
- Emergency preparedness and prevention requirements (e.g., contingency planning);
- Annual or bi-annual (depending upon state regulation) hazardous waste activity report filed with state authority by March 1);
- Compliance with on-site storage and satellite accumulation rules. Wastes must be shipped off-site for treatment within 180 days for small quantity generators and 90 days for large quantity generators;
- In preparation for shipment, compliance with DOT shipping requirements (49 CFR Part 172 and Part 172, Subpart F) and packaging in containers (49 CFR Parts 173, 178, and 179); and
- Training.

Additional information on generator requirements can be found at the following sites:

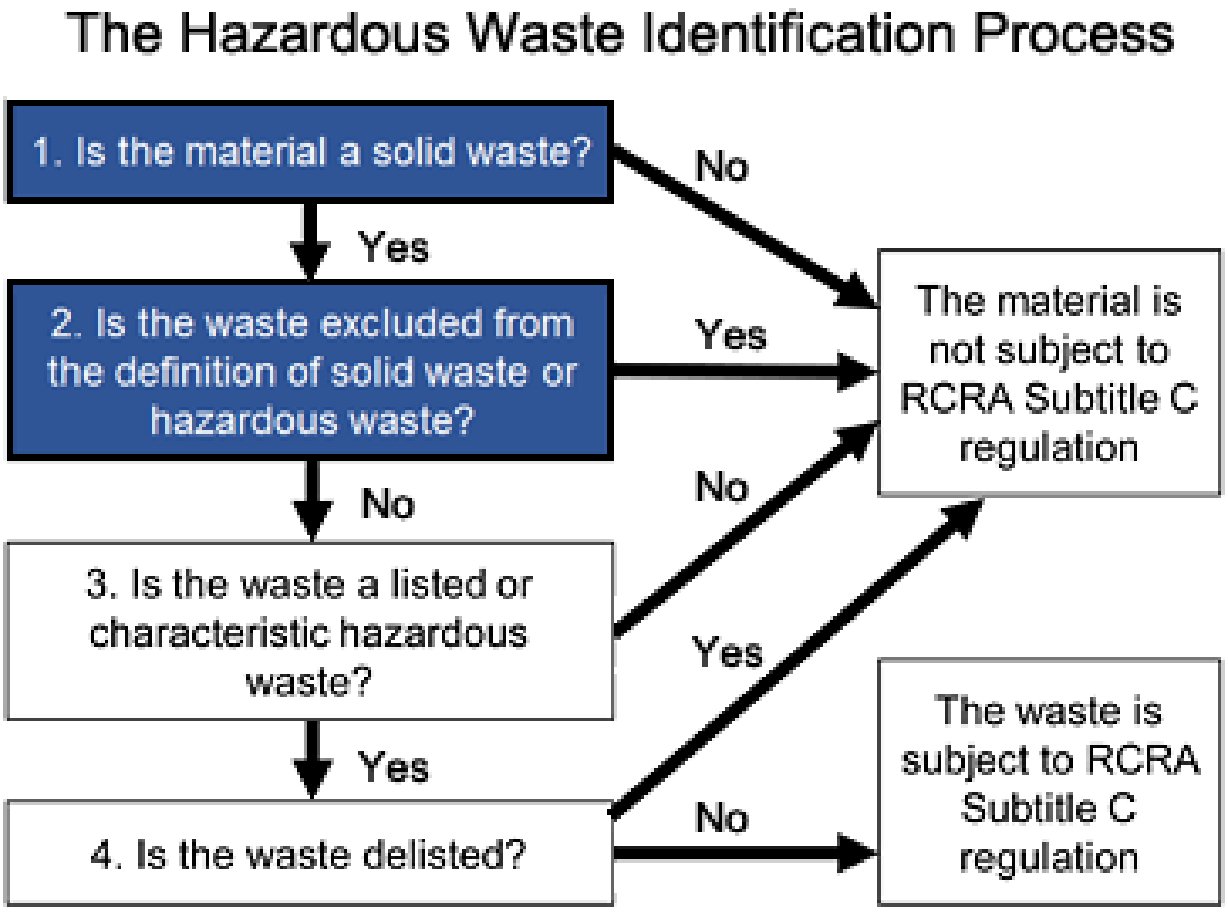
- https://www.epa.gov/hwgenerators/hazardous-waste-generator-regulatory-summary

c. Waste Identification

- Solid waste/nonhazardous waste.
  - Per 40 CFR § 257.2, with some exceptions, "Solid waste means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities…"
  - In general, most solid wastes tend to be nonhazardous wastes including typical trash.
- Solid waste/hazardous waste.
  - A solid waste could be considered hazardous waste for several reasons.

- Wastes that exhibit a hazardous characteristic as defined under the regulations (e.g., ignitability, corrosivity, reactivity, or toxicity (TCLP), 40 CFR §261.21 – §261.24);
- Hazardous wastes from a non-specific and specific sources (e.g. the F and K lists at 40 CFR § 261.31 and § 261.32);
- Hazardous wastes included on the lists of discarded commercial chemical products, off-specification species, container residues, and spill residues thereof (e.g., the U and P lists at 40 CFR § 261.33(e) and (f)). P listed materials are acute hazardous wastes.
- Some states have their own criteria for hazardous waste in addition to federal requirements.

- Resource Conservation and Recovery Act (RCRA) Subtitle C is a program to manage hazardous wastes from cradle to grave.
- Solid waste/acute hazardous waste.
  - According to the EPA, "The waste contains such dangerous chemicals that it could pose a threat to human health and the environment even when properly managed. Such wastes are known as acutely hazardous wastes."
  - An acute hazardous waste is accompanied by the hazard code (H). "P" and some "F" listed wastes fit in this category.
  - Acute hazardous wastes have more stringent requirements than non-acute hazardous wastes.
  - MOCA (U158) is not an acute hazardous waste.



Source: https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions#tablesw
MOCA: Waste – Waste Identification Matrix (Adv.)

MOCA Waste Identification Matrix[1]

Waste A \ Waste B	MOCA pellets or melted MOCA	PPE Known To Be Contaminated with MOCA	Filters Known To Be Contaminated with MOCA	MOCA/polyol or amine blends	Prepolymer	Polyurethane scrap parts made using MOCA	RCRA Empty Containers and Liners
MOCA pellets or melted MOCA	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste
PPE Known To Be Contaminated with MOCA	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste
Filters Known To Be Contaminated with MOCA	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste
MOCA/polyol or amine blends	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste
Prepolymer	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste
Polyurethane scrap parts made using MOCA	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste
RCRA Empty Containers and Liners	U158 Hazardous Waste	U158 Hazardous Waste	U158 Hazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste	Nonhazardous Waste

Key

The MOCA Waste Identification Matrix is provided for reference only. The MOCA Waste Identification Matrix does not cover all situations involving waste and professional assistance is advised. Comply with all Federal, State, Provincial and Local regulations.

Directions on how to use this matrix

This matrix is meant to help you determine if a waste would be hazardous or nonhazardous if you mix two waste streams. There is a list of potential waste streams going down (Waste A) and across this matrix (Waste B). In order to use this table, choose one waste stream down the matrix (Waste A) and one across the matrix (Waste B). Trace a line across and down from those two waste streams and the location that they intersect would be the classification of the waste if mixed. As an example, if you mix Waste A-"Filters Known to Be Contaminated with MOCA" and Waste B-"Prepolymer" the resulting waste would be "U158 Hazardous Waste." If you mix, Waste A-"Prepolymer" and Waste B-"MOCA/polyol or amine blends" the resulting waste would be "Nonhazardous Waste."

d. Mixture and Derived-From Rules

- EPA has adopted what is known as the mixture and derived-from rules. These rules regulate the mixing of hazardous wastes with nonhazardous wastes.

- In most cases, if a nonhazardous or characteristic waste is mixed with a listed waste, the entire mixture is considered to be the listed hazardous waste. This would increase the overall volume of listed hazardous waste.
    - One good practice is separating waste streams to minimize generation of hazardous waste.
- In most cases, a mixture involving only characteristic wastes is hazardous if the mixture itself exhibits a characteristic. Similarly, treatment residues and materials derived from characteristic wastes are hazardous if they themselves exhibit a characteristic.
- Prior to becoming a waste, MOCA in a polyol is not the "sole-active ingredient" and therefore the resulting waste would not be listed (No U listing) and would be a nonhazardous waste.
- Discarded MOCA and cleanup materials from a pure MOCA spill would retain the U158 hazardous waste listing.
    - Spent PPE and filters would also retain the U158 hazardous waste listing.

e. Waste Streams that Must Be Managed as a Hazardous Waste

Therefore, waste streams which must be managed as RCRA hazardous include the following:

(a) Any remaining MOCA (virgin or off-spec) commercial chemical product or residue to be discarded;

(b) Any mixture or rinsate waste where unreacted waste MOCA has been commingled;

(c) Any discarded items (e.g., gloves, rags, and aprons) or other waste materials (e.g., floor-dry) which have adsorbed, or which contain unreacted MOCA;

(d) Any manufacturing intermediate which may contain unreacted MOCA as the sole active ingredient;

(e) Any residue remaining in a container or an inner liner of a container (except a "RCRA empty" container as defined in the regulations); and

(f) Any waste residues or contaminated soil, water, or other debris, such as resulting from the cleanup of a spill of MOCA.

(g) For Mixer Flushing: we use DBE (Dibasic Acid Esters)
Dibasic esters are processed dimethyl esters of succinic, adipic, and glutaric acids. They are environmentally friendly products since they are non-flammable, non-corrosive, and biodegrade quickly. In alcohol, they are readily soluble, while in water, they are slightly soluble. Dibasic esters are clear, colorless, and smell fruity. Dibasic ester is a good stripping agent. They quickly clean through paint, resin, inks, coatings, polyurethane, and polar substances.

(h) For soak cleaning of stirrers, mixers, molds, removing PU from inserts, dissolving PU, etc., Tetraethylene Glycol (CAS #112-60-7) heated to 325°F, can be used;

f. Waste – Management (Basic)

- Store wastes in proper containers.
- Do not mix different types of wastes without permission since some wastes may chemically react when mixed.
- Properly label waste containers.
- In general, keep waste containers closed when not adding or emptying waste.
- Keep the outside of waste the containers clean to prevent exposure to others.
- When filled, take containers to proper storage location for shipping waste out for disposal.

g. Managing Waste – Empty Containers

- RCRA Exclusions: Residues of hazardous waste in empty containers.
    - Empty containers that held non-acute hazardous chemicals are not regulated as hazardous waste if they meet the definition of "RCRA empty." Under EPA 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., pouring, pumping, aspirating) and no more 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 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)].

The following are considerations for rinsate, or residue generated by cleaning RCRA empty containers or inner liners.

- If an RCRA empty container or inner liner is rinsed, the rinsate or residue would need to be evaluated to determine if it is a hazardous waste.
- Although it would no longer carry the original listed hazardous waste designation, the rinsate or residue could potentially be a characteristic hazardous waste.

DOT Considerations: 49 CFR § 173.29 Empty Packaging.

- (a) General. Except as otherwise provided in this section, an empty packaging containing only the residue of a hazardous material shall be offered for transportation and transported in the same manner as when it previously contained a greater quantity of that hazardous material.

- (b) Notwithstanding the requirements of paragraph (a) of this section, an empty packaging is not subject to any other requirements of this subchapter if it conforms to the following provisions:
    - (1) Any hazardous material shipping name and identification number markings, any hazard warning labels or placards, and any other markings indicating that the material is hazardous (e.g., RQ, INHALATION HAZARD) are removed, obliterated, or securely covered in transportation. This provision does not apply to transportation in a transport vehicle or a freight container if the packaging is not visible in transportation and the packaging is loaded by the shipper and unloaded by the shipper or consignee;
    - (2) The packaging -
        - (i) Is unused;
        - (ii) Is sufficiently cleaned of residue and purged of vapors to remove any potential hazard;
        - (iii) Is refilled with a material which is not hazardous to such an extent that any residue remaining in the packaging no longer poses a hazard; or
        - (iv) Contains only the residue of -
            - (A) An ORM-D material; or
            - (B) A Division 2.2 non-flammable gas, other than ammonia, anhydrous, and with no subsidiary hazard, at a gauge pressure less than 200 kPa (29.0 psig); at 20 °C (68 °F); and
    - (3) Any material contained in the packaging does not meet the definitions in 49 CFR §171.8 of this subchapter for a hazardous substance, a hazardous waste, or a marine pollutant.
- Although “RCRA empty” containers (drums and liners) may not be defined as hazardous waste, disposal of them as nonhazardous waste may pose liability issues. Below are some considerations related to disposal of containers (including liners).
- Landfill considerations.
    - In some cases, disposal of intact containers into a municipal solid waste landfill may not be an option since some landfills have a ban on accepting recognizable containers.
    - It may be possible to process the containers (e.g., deface labels and crush containers) and send them to a landfill. However, this could pose long-term liability if the landfill is found to be contaminated.
- The containers could be disposed of using a licensed incinerator. Although there are greater short-term costs, this could reduce long-term liability.

- Empty containers should not be reused (e.g., trash cans, parts bins, etc.).

h. On Site Treatment of MOCA Wastes [3]

Under EPA regulations, for a generator that is not a permitted TSDF (treatment, storage, and disposal facility), there are a limited number of options to treat hazardous waste on- site without a hazardous waste permit.

- A generator may perform elementary neutralization (adjusting pH of a waste that only exhibits the characteristic of corrosivity).
- A generator may treat their hazardous waste on-site in a container to make it either nonhazardous or less hazardous if they comply with all of the applicable hazardous waste generator requirements in 40 CFR §262.34 and the treatment is not thermal treatment.
- When treating a listed waste, the resulting treatment residue would still carry the listing of the original hazardous waste.
- Mixing discarded pure MOCA or cleanup MOCA residue with a prepolymer would result in a hazardous waste with the U158 listing.

i. Feed Stocks Containing a Mixture of MOCA and At Least One Additional Active Ingredient

MOCA is a commercial chemical product or manufacturing chemical intermediate having the generic name listed in the "U" list of 40 CFR 261.33(f). Where unreacted MOCA feed stock consists of MOCA as the sole active ingredient (i.e., the MOCA feed stock can be described as a chemical substance manufactured or formulated for manufacturing or commercial use that consists of the commercially pure grade of the chemical, technical grades or formulations in which the chemical is the sole active ingredient), then any wastes consisting of unreacted feed stock should be regarded as a RCRA hazardous waste.

Note, however, that if the feed stock containing MOCA has at least one other active ingredient (i.e., the feed stock merely includes a chemical on the "U" list), the wastes of such a mixture of compounds do not meet the definition of U158 and are not to be regarded as RCRA hazardous solely clue to the U158 listing *(see* "Comment" at 40 CFR 261.33 (d)).

Of course, if the waste unreacted mixed feed stock of MOCA and other active ingredients exhibits a RCRA hazardous characteristic (i.e., ignitability, corrosivity, toxicity, or reactivity, as defined at 40 CFR 261), then the waste should be managed as a RCRA hazardous waste.

[3] A generator potentially may treat wastes that are not RCRA hazardous wastes. In many cases, an A-side (prepolymer) and B-side (nonhazardous curative) may be reacted to make a nonhazardous polyurethane waste. If performing on-site in-tank treatment, consider potential for exposure and controls to prevent that exposure (e.g., engineering controls, hygiene, PPE). As an example, when reacting to a standard prepolymer (with high free isocyanate content) and curative, in addition to skin exposure potential, there could be potential exposure to free isocyanate vapors. Local ventilation would be a consideration to prevent overexposure to free isocyanate.

Therefore, when the unreacted feed stock is a mixture of two or more active ingredients, and these ingredients are not listed on the "U" or "P" lists of 40 CFR 261.33, and where the process generating the unreacted feed stock is not listed on the "F" and "K" lists of 40 CFR 261, the feed stock is not a listed RCRA waste. Only where the unreacted feed stock consists of a single or sole active ingredient must the generator consult the Chemical Abstracts Service number ("CAS No I 01-14-4.") identifying the chemical and comparing this with the CAS No. of the "P" or "U" lists to be certain whether the substance is in fact the substance intended by the RCRA listing.

j. Disposal of MOCA Wastes, Waste Minimization, and Decontamination Procedures

With respect to MOCA, the principal concern under RCRA relates to disposing of waste materials contaminated with MOCA, such as protective clothing, shipping drums, and containers. Also, unreacted MOCA as a by-product of mixing machine calibration and occasionally spilled MOCA pellets or melted MOCA can give rise to the generation of hazardous waste. However, a processor normally can minimize the generation of such hazardous waste materials by reacting the MOCA in a fiber drum with TDI or MDI.

MOCA decontamination procedures vary depending on the nature of the process operation. Some of the more common methods for decontaminating drums or other waste material consist of applying chemical solutions that react to the MOCA. Larger quantities of MOCA that become unfit for use in normal processing have been reacted with a prepolymer to make a useful polyurethane product, such as loading dock bumper guards. This approach may minimize the generation of MOCA as a hazardous waste.

k. Waste – Disposal

Dispose of waste according to Federal, State, Provincial and Local regulations. In the US, hazardous waste should be sent out using a Uniform Hazardous Waste Manifest, transported by a licensed waste hauler, and disposed at a licensed treatment, storage, and disposal facility (TSDF).

Nonhazardous waste may be typically incinerated and sometimes landfilled. Waste disposal sites may have different limitations on the types of waste they accept.

l. Waste - Vendor Selection

- Finding a sustainable waste service provider is important for many reasons including the “cradle-to-grave” responsibility for hazardous waste management.
- It can be challenging to find a waste service provider. These are some possible ways to find providers.
    - Some states maintain lists of licensed waste service providers.
    - Ask others about waste vendors that they use (word-of-mouth).
    - Hazardous waste service providers can be found using the EPA database called The Resource Conservation and Recovery Act Information (RCRA Info). This can be accessed at the following site: https://www.epa.gov/enviro/rcrainfo-search-user-guide.

- This tool is relatively complicated to use.

- It is a good practice to perform a background check before doing business with a waste service provider. The following are some possible ways to perform a background check.
    - Search an EPA database to find compliance and enforcement information on waste vendors. This information can be found in EPA's Enforcement and Compliance History Online (ECHO) database at the following site: https://echo.epa.gov/.
    - Search a DOT database to find safety information related to transporters. This can be found on DOT's Safety and Fitness Electronic Records (SAFER) System at the following site: http://safer.fmcsa.dot.gov/CompanySnapshot.aspx.
    - Check financial references (e.g., Dun and Bradstreet reports).
    - Check the insurance carried by the waste vendor.
    - Check customer references.
    - Physically audit the waste vendor.

4. Hazardous Waste Generator Standards

If unreacted, waste MOCA is considered to be a RCRA hazardous waste, and as such all the state and federal generator standards are applicable. The complexity of the applicable standards depends on the volume of hazardous wastes generated and the status of the polyurethane processor as a Very Small Quantity, Small Quantity, or Large Quantity Generator.

Depending on the generator status of the facility, the generation of waste MOCA may result in the application of the following RCRA regulations:

(a) Hazardous waste generator status determination

(b) Notification of EPA and state authority and application for an EPA facility identification number;

(c) Compliance with recordkeeping, packaging, labeling, and manifesting of waste;

(d) Weekly inspections of waste storage areas

(e) Emergency preparedness and prevention requirements (i.e., contingency planning);

(f) Annual or bi-annual (depending upon state regulation) hazardous waste activity report filed with state authority by March I);

(g) Compliance with on-site storage and satellite accumulation rules. Wastes must be shipped off-site for treatment within 180 days for small quantity generators and 90 days for large quantity generators; and

(h) In preparation for shipment, compliance with DOT shipping requirements (49 CFR Part 172 and Part 172, Subpart F) and packaging in containers (49 CFR Parts 173, 178, and 179).

Since the EPA regards any waste that is mixed with or that contains a listed waste such as MOCA to be a regulated hazardous waste, precautions should be taken to minimize contamination of other materials with MOCA.

The following table provides a summary of requirements for Hazardous Waste Generators,

Hazardous Waste Generator Regulatory Summary
(https://www.epa.gov/hwgenerators/hazardous-waste-generator-regulatory-summary)

Requirement	Very Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
Quantity Limits The amount of hazardous waste generated per month determines how a generator is categorized and what regulations must be complied with.	≤100 kg/month, and ≤ 1 kg/month of acute hazardous waste, and ≤100 kg/month of acute spill residue or soil §260.10	>100 and <1,000 kg/month §260.10	≤1,000 kg/month, or > 1 kg/month of acute hazardous waste, or > 100 kg/month of acute spill residue or soil §260.10
EPA ID Number Acquire a unique EPA identification number that identifies generators by site.	Not required	Required §262.18	Required §262.18
On-Site Accumulation Quantity Determine amount of hazardous waste generators are allowed to "accumulate" on site without a permit.	≤ 1,000 kg or ≤ 1 kg acute hazardous waste or ≤ 100 kg of acute spill residue or soil §§262.14(a)(3) and (4)	≤6,000 kg §262.16(b)(1)	No limit

Accumulation Time Limits Determine amount of time hazardous waste is allowed to accumulate on site.	None	≤180 days or ≤270 days (if transporting greater than 200 miles) §§262.16(b)-(d)	≤ 90 days §262.17(a)
Accumulation Requirements Manage hazardous waste in compliance with certain technical standards.	None	Basic requirements with technical standards for containers, tanks, drip pads or containment buildings §§262.16(b)(2)- (5)	full compliance for management of containers, tanks, drip pads or containment buildings §§262.17(a)(1)-(4)
Personnel Training Ensure appropriate personnel complete classroom or on-the-job training to become familiar with proper hazardous waste management and emergency procedures for the wastes handled at the facility.	Not required	Basic training required §262.16(b)(9)(iii)	Required §262.17(a)(7)
Requirement	**Very Small Quantity Generators**	**Small Quantity Generators**	**Large Quantity Generators**
Contingency Plan and Emergency Procedures Develop procedures to follow during an unplanned major event.	Not required	Basic planning required §§262.16(b)(9)	Full plan required Part 262 subpart M (from §262.17(a)(6))

Preparedness and Prevention Develop procedures to follow in the event of an emergency.	Not required	Required §262.16(b)(8)- (9)	Required Part 262 subpart M (from §262.17(a)(6)
Air Emissions Control hazardous air emissions from tanks and containers	Not required	Not required	Required Part 265 subparts AA, BB and CC from §262.17(a)(l) and (2)
Land Disposal Restrictions Meet standards for placing on the land and associated requirements for certifications, notifications, and waste analysis plans	Not required	Required Part 268 from §262.16(b)(7)	Required Part 268 from §262.17(a)(9)
Manifest Tracking hazardous waste shipments using the multiple copy manifest - required by the Department of Transportation (DOT) and EPA	Not required	Required Part 262 subpart B	Required Part 262 subpart B

Requirement	Very Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
Waste Minimization Certify steps taken to reduce or eliminate the generation of hazardous waste	None	Good faith effort required §262.27	Program in place required §262.27
Pre-Transport Requirements Package and label hazardous waste for shipment off site to a RCRA facility for treatment, storage, or disposal	Only if required by the DOT or the state	Required §§262.30-262.33	Required §§262.30-262.33
Biennial Report Report data from off-site shipments of waste during the previous calendar year	Not required	Not required	Required §262.41
Exception and Additional Reporting Report if any required copies of signed manifests are not received back. Provide information on quantities and disposition of wastes upon request	Not required	Required §§262.42(b) and 262.43	Required §§262.42 and 262.43
Recordkeeping Maintain records of waste testing, manifests, biennial reports, and exception reports	Not required	Required (except biennial reports) §262.11(f) and §262.40(a) and (d)	Required §262.1l(f) and §262.40

Requirement	Very Small Quantity Generators	Small Quantity Generators	Large Quantity Generators
Facility Type Send off-site shipments to appropriate facilities for management	Facilities noted in §§262. l 4(a)(5)	RCRA permitted/interim status facility Parts 264/265, 266/267 and 270	RCRA permitted/interim status facility Parts 264/265, 266/267 and 270
Closure Close equipment, structures, soils, and units by meeting specified performance standards and disposal and decontamination requirements	Not required	Required for tanks, drip pads and containment buildings - Tanks only §262.16(b)(3)(vi) Unit specific Part 265, subpart W and DD for drip pads and containment buildings	Required - General §262.17(a)(8) - Unit specific Part 265, subpart W for drip pads

5. Special Requirements for Large Quantity Generators

A processor who has generated a total of 2,200 pounds or more of hazardous waste in any calendar month (including MOCA and all other hazardous waste) qualifies as a Large Quantity Generator. A Large Quantity Generator must comply with 40 CFR 265.30-265.37, setting forth emergency preparedness and prevention requirements. These criteria dictate emergency communication facilities, fire control equipment, assignment of an emergency coordinator, establishment of emergency procedures and other requirements. It is recommended that Small Quantity Generators voluntarily comply with these requirements, as feasible. Basic planning is required for Small Quantity Generators.

Several requirements that have been promulgated for hazardous waste treatment, storage and disposal facilities are also applicable to Large Quantity Generators. For example, polyurethane processors that are Large Quantity Generators must document personnel training for each employee whose duties may involve hazardous wastes.

6. Laundering Items that Contain MOCA

When an item to be laundered contains waste that is mixed with a commercially pure grade of MOCA, any technical grades of MOCA and all formulations in which MOCA was the *sole active ingredient,* the item to be laundered should be viewed as being contaminated with a *listed* RCRA hazardous waste.

Note that a different conclusion would be reached when making the RCRA hazardous waste determination for a waste material that had contained a mixture of MOCA and other active ingredients. In such a case, if the waste does not exhibit an RCRA hazardous waste characteristic and if the generating process is not listed on the F and K lists, it is not an RCRA hazardous waste. Similarly, where the manufacturing process generates a process residue or waste that contains several other substances, one of which is MOCA, if the waste does not exhibit a RCRA hazardous waste characteristic, the waste does not meet the definition of a RCRA hazardous waste.

Where aprons, caps, gloves, rags or other items to be laundered have adsorbed or contain commercially pure grade of MOCA, any waste manufacturing intermediate which consists of MOCA as the sole active ingredient, any residue remaining in a container or an inner liner of a container (except an "empty" container, as discussed above), any residue or contaminated soil, water or other debris resulting from the cleanup of a spill of MOCA and any other wastes derived from this listed waste, then the item contains a RCRA hazardous waste, and special laundering requirements may apply.

Where items to be laundered for reuse contain residues of one or more RCRA listed hazardous wastes (such as MOCA or TOI residues) and where such items are amenable to being cleaned at an industrial laundry (e.g., uniforms, aprons, gloves, and towels), the USEPA has refused to establish a policy at the federal level concerning how such items would be regulated, or how the wash or rinse waters from the industrial laundry would be regulated. Instead, USEPA has left the matter to be decided on a case-by-case basis by each state.

In the absence of a determination to the contrary by the state's implementing agency, the USEPA takes the position that the "contained-in" rule is to be applied, which provides that until such time as the soiled item no longer "contains" the RCRA hazardous waste residue, the item must be managed as a RCRA hazardous waste, and where laundering removes these residues, the laundered item is no longer subject to hazardous waste regulation. Therefore, in the absence of a state policy to the contrary, there is no federal provision excluding industrial laundries or shipments of soiled linens from the full breadth of hazardous waste regulation (e.g., industrial laundries would be required to obtain hazardous waste facility permits before accepting items containing hazardous waste, laundry trucks would have to be licensed as waste transporters, and manifests would be required).

Many states and territories have taken the position that whether or not a towel or other launderable item is regulated as a hazardous waste depends upon how the residues came to be in the item. In most states, if unused product is placed on an item (such as being poured from a product container onto a towel to be used to wipe a surface), then the towel is only hazardous if it exhibits a hazardous characteristic. The basis for this view is that the product (even if listed on the U or P list) is not a waste, and therefore the definitions of the U and P lists at 40 CFR 261.33 (e) and (f) do not apply. If, on the other

hand, the towel is used to clean up spilled or excess residue, then where the residue is characteristically hazardous, the towel is hazardous only if it exhibits the characteristic, and if the residue is "listed", then the towel is considered hazardous until it no longer "contains" the residue.

It has also been left to each authorized state to determine how clean the item must be before it is regarded as no longer containing the listed waste. In many states, industrial laundries are not required to obtain a special hazardous waste facility permit nor a solid waste facility permit, as the linen items are being returned to and are not regarded as a waste, however, many launderers may need to obtain or revise other permits, such as wastewater discharge permits or air pollution control permits. In addition, most states do not require a special transporter or hauling permit to transport launderable items between the generator and the laundering facility.

In virtually all states, industrial laundries may not accept linens that are saturated with a hazardous waste, or containers in which the hazardous waste is present as a free liquid. In most states, the implementing agency reserves the right to approve or disapprove the use of an industrial laundry on a case-by-case basis. In general, states have provided upon request, a letter of approval for a facility to manage industrial towels and soiled clothing containing residues of either characteristic or listed hazardous wastes have to be managed as hazardous wastes until such time as they are sent to an industrial launderer or dry cleaner to be cleaned and then returned to the owner, but exclude these wastes from hazardous waste regulation once shipped to the launderer (i.e., a laundry is not required to have a hazardous waste facility permit, they do not have to be licensed as waste transporters if they operate laundry trucks, and they are not required to use hazardous waste manifests for the shipment of solid fabrics). Note that Department of Transportation regulations continue to apply.

7. MOCA Regulation Under SARA Title III

The "Emergency Planning and Community Right-to-Know Act," commonly referred to as SARA Title III or EPCRA, mandates a nation-wide program for emergency response planning at the local community and state levels. Its intent is to provide state and local governments with the necessary information to identify chemical hazards and plan for hazardous substance emergencies. The legislation is an extension of the Hazard Communication Standard that provides workers with the "right-to-know" potential hazards associated with chemicals.

EPCRA regulations (40 CFR Parts 350- 372) establish four types of reporting for facilities that store, process, or use specific chemicals.

a. Emergency Planning and Notification

EPCRA Section 302 requires that facilities notify the State Emergency Response Commission, fire department, and Local Emergency Planning of the presence of any "extremely hazardous substance" or EHS (see 40 CFR Part 355 Appendix A and B) if the facility stores in excess of the Threshold Planning Quantity (TPQ). MOCA is not included on the list of EHS and thus notification is not required. A comprehensive summary of the applicability of EPCRA to specific chemicals is provided in the EPA Consolidated List of Chemicals.

Facilities processing MOCA are subject to the Emergency Release Reporting Requirements of section 304 of SARA if there is a release of a reportable quantity (RQ) (10 pounds or more) of MOCA "into the environment." Some states lower the release reporting level to any

amount of MOCA released into the environment. The release must be reported to the National Response Center (800/424-8802), the State Emergency Response Commission ("SERC") and the Local Emergency Planning Committees ("LEPC").

A facility may make the initial emergency notification to the LEPC, SERC and the National Response Center by telephone, radio, or in person, but this emergency notification must be followed up by written notification within 15 days, and generally as soon as possible.

b. Hazardous Chemical Notification and Inventory Reporting Requirements of Sections 311-312

EPCRA Sections 311 and 312 apply to facilities that store OSHA hazardous chemicals in excess of the TPQ from Section 302 or any other OSHA Hazardous Chemical in excess of 10,000 pounds. Reports include:

1. An initial notification that includes an SOS for the chemicals present
2. Subsequent annual inventory reports. Reports are made to the SERC, LEPC and the local fire department.

A polyurethane processing facility that has on hand at the facility at any point in time in the course of a calendar year 10,000 pounds or more of MOCA must comply with the reporting requirements of sections 311 and 312 of SARA.

A facility that is required to submit an SOS sheet for MOCA must also annually file a Tier I or a Tier II form under section 312. State law governs which Tier Report is required. A Tier I form includes detailed information about MOCA, and information about the amount and general location of where the chemical is stored and used at the facility. The completed Tier I/Tier II forms must be submitted to the SERC, LEPC, and the local fire department by March 1 of each calendar year.

c. Toxic Chemical Release Reporting Requirements Section 313

EPCRA Section 313 requires facilities that manufacture, process, or use listed chemicals (40 CFR Part 372. 65) in greater than threshold amounts submit annual toxic chemical Form A or R release reports. The Form R reports include releases and transfers of toxic chemical to designated facilities and to the environment.

Toxic Chemical Release Information Form ("EPA Form R") informs the government and public about off-site transfers and releases of toxic chemicals to the environment. A polyurethane processing facility is subject to a Form R reporting requirement for MOCA if it has 10 or more full-time employees; and processes 25,000 lbs. or more of MOCA in any calendar year. The Form Risa chemical-specific report, and the report must be completed specifically for MOCA, as provided at 40 CFR 372.65. The Toxic Chemical Release Form is due annually on July 1.

A number of MOCA processors have been required to file Form R reports annually for the chemical. None has experienced air emissions of MOCA in excess of one pound per year.

Most processors will be able to use TRI Form A instead of Form R. It is a simplified reporting form that is much easier to complete. Form A can be used for chemicals that are not PBT chemicals, that are under 1,000,000 pounds, and that the total reportable amount doesn’t exceed 500 pounds..

8. Clean Air Act Regulations

Title V of the Clean Air Act requires permitting of sources and emission controls for criteria pollutants and hazardous air pollutants. Criteria pollutants include VOC, particulate, NOx, SOx, CO, and lead. In particular emissions of particulate will need to meet Ambient Air Quality Standards (40 CFR Part 50.6). Title V of the Clean Air Act authorizes state and federal operating permit programs (40 CFR Part 70 and 71). Facilities need to estimate emissions of MOCA as well as other hazardous air pollutants and criteria pollutants to determine whether an air permit is required and what type is needed.

MOCA is classified by EPA as a Hazardous Air Pollutant (HAP) and is listed for regulation in Section 112 of the Clean Air Act. Facilities that have HAP emissions may be regulated either as major sources or area sources. Any stationary source that has the "potential to emit" 10 tons per year (TPY) of any other single HAP into the environment or 25 TPY of any combination of hazardous air pollutants listed in Section 112 will be considered a Major Source. An area source is any source of hazardous air pollutants that is not a major source.

These facility emissions determinations may be calculated based upon use of emission factors from EPA or actual stack tests. The PMA conducted stack tests in 1996 for MOCA, TOI, and MDI.

Major sources of HAPs are required to obtain Title V Air Permits and apply Maximum Achievable Control Technology (MACT) to reduce emissions of hazardous air pollutants. Since EPA has not yet published a MACT for MOCA a facility that is a major source may be required to determine an applicable control technology or Case-by-Case MACT. However, as noted in 7. a. of this appendix, no MOCA processor has experienced actual emissions of one pound of MOCA in a year. Minor or Area sources of I-IAP's do not need to apply a MACT unless it is published by EPA. (40 CFR Part 63 NESHAP for Hazardous Air Pollutants). As noted above, emissions of MOCA from polyurethane facilities are generally very low and most would be classified as Area Sources.

9. Transportation of MOCA and MOCA Wastes

Transportation of hazardous materials that are capable of posing unreasonable risk to health, safety, and property when transported in commerce are regulated by the Department of Transportation (DOT) under 49 CFR. MOCA is listed by DOT in the Tables found in 40 CFR 172.101 (also referred to as Table 172.101) and also Appendix A of this part, and thus meets the definition of a Hazardous Substance when transported in quantities greater than the CERCLA Reportable Quantity of 10 pounds. Regulation of MOCA by DOT will include both the receipt of raw material and the shipping of MOCA Hazardous Wastes.

DOT Hazardous Materials regulations require shipping of regulated materials using appropriate shipping descriptions, markings, placarding, containers, and shipping papers described in 49 CFR 172. The backbone of the Hazardous Materials Regulations is the DOT Hazardous Materials Table 49 CFR 172.101. As a Hazardous Substance regulated by DOT, the shipping Description from Table 172.101 for MOCA is:

- Proper Shipping Name — Environmentally Hazardous Substance, Solid, N.O.S.
- Additional Description — 4,4'-methylene bis-(2-chloroaniline)

- Hazard Class and Division Class 9
- UN Identification Number UN 3077
- Packing Group PG III

For MOCA Hazardous Wastes, the Proper Shipping Name may include "Waste Environmentally Hazardous Substance," or the wastes may be shipped as a "Hazardous Waste, Solid".

The DOT Shipping Description tells what is in the container and is included on the markings (labels) that are applied to the outside of the shipping container. The Marking will include the 4" X 4" Hazardous Material Class Label (Hazard Class 9). The Marking may also include other descriptions or cautions and subsidiary markings such as Orientation Arrows like "This End Up". For MOCA Wastes, the appropriate Container Markings include both a Hazardous Waste Label and the Hazard Class 9 Label. The labels need to be placed near the Shipping Descriptions and if the bulk packaging is greater than 119 gallons, marking must be placed on two sides of the container.

Placards tell what the hazard is from a distance and are displayed on all four sides of the transportation vehicle. It is the shipper's responsibility to offer appropriate placards when shipping placarded amounts of hazardous materials, including wastes. In most cases a shipment that exceeds 1,000 lbs. requires placarding; however, 49 CFR 172.504(f)(9) specifies that only bulk hazard class 9 packaging needs to be marked with the Class 9 Placard. It is unlikely that bulk shipments of MOCA wastes would be made from polyurethane casting facilities.

Shipping Papers will include a Hazardous Materials Bill of Lading for receipts of MOCA and a Hazardous Waste Manifest for offsite shipments of MOCA hazardous waste. DOT requires that each person who offers hazardous materials for transportation accurately describe the material. The shipping paper must contain a basic description of the materials offered for transportation from Table 172.10 I and will appear as one of either of the two following descriptions:

- *UN 3077, Environmentally Hazardous Substance, Solid, NOS. (4,4 '-methylene bis- (2-chloroaniline), 9, PG III*
- *UN 3077, Hazardous Waste Solid, NOS. (4,4'-methylene bis-(2-chloroaniline), 9, PG III (U 158)*

In addition, entries to shipping papers must be printed legibly in English and must include the following:

- The total quantity of material in kg
- Marked with X or HM or RQ in the first column if the RQ is exceeded (RQ for MOCA is 10 pounds)
- An emergency response telephone number that is monitored at all times during the transport of the hazardous material by someone knowledgeable about the material including:
    - Hazards of the material
    - Emergency Response information

- Accident mitigation information

- A certification by the shipper that the hazardous material has been prepared for shipment in accordance with Federal Hazardous Materials Regulations. For Hazardous Waste Manifests this requirement is met by the Generator/Offerer's Certification

The purpose of packaging requirements is to assure that hazardous materials remain in the package during transportation. DOT Hazardous Materials that are offered for transportation must comply with Performance Packaging requirements (49 CFR 173.213) or the Packaging Level for PG 111 (49 CFR 178).

Shippers and receivers of hazardous materials need to conduct training of HazMat Employees every three years. A HAZMAT employee may be a person that loads or unloads hazardous materials, signs shipping papers (manifests), conducts labeling or marking or container selection. Training includes:

1. General Awareness of the regulatory requirements
2. Function Specific training for the hazardous materials and activities conducted by the employee.
3. Safety and Emergency Response Training
4. Security awareness training
5. In depth security Training and for shippers who offer a placarded quantity of Hazardous Materials. In most cases MOCA processors are not expected to ship placarded quantities.
6. Function Specific to the Hazardous Material and work activity

Training and Guidance documents for DOT are posted at http://www.phmsa.dot.gov/ and training documents at http://www.fmcsa.dot.gov/safety-security/hazmat/hmawareeng.htm.

10. Toxic Substances Control Act (TSCA)

The Toxic Substances Control Act of 1976 (TSCA) provides the EPA with the authority to require reporting, record-keeping and testing, and restrictions relating to chemical substances in the areas of manufacturing, processing, distribution, importation, use and disposal. Some substances are generally excluded from TSCA, including, Federal Insecticide, Fungicide, and Rodenticide Act (Fl FRA) pesticides, tobacco and tobacco products, certain materials regulated under the Atomic Energy Act, firearms and ammunition, and foods, food additives, drugs, cosmetics, and devices regulated under the Federal Food, Drug, and Cosmetic Act (FFDCA).

- The following are some TSCA provisions.
  - Section 5, pre-manufacture notification (PMN) for "new chemical substances" before manufacture.
  - Section 4, testing of chemicals by manufacturers, importers, and processors where risks or exposures of concern are found.
  - Significant New Use Rules (SNURs), under Section 5, when a "significant

new use" is identified that could result in exposures to, or releases of, a substance of concern.

- o TSCA Inventory, under Section 8, which contains more than 83,000 chemicals. As new chemicals are commercially manufactured or imported, they are placed on the list.
  - ➢ MOCA, CAS# 101-14-4, is on the TSCA Inventory.
- o Importing or exporting chemicals, under Sections 12(b) and 13, in compliance with certification reporting and/or other requirements.
- o Section 8, reporting and record-keeping by persons who manufacture, import, process, and/or distribute chemical substances in commerce.
- o Section 8(e), immediately informing the EPA by any person who manufactures (including imports), processes, or distributes in commerce a chemical substance or mixture and obtains information which reasonably supports the conclusion that such substance or mixture presents a substantial risk of injury to health or the environment, except where EPA has been adequately informed of such information.

On .lune 22, 2016, the Frank R. Lautenberg Chemical Safety for the 21st Century Act which amends the Toxic Substances Control Act (Amended TSCA) was enacted. According to EPA, this includes the following improvements:

- Mandatory requirement for EPA to evaluate existing chemicals with clear and enforceable deadlines;
- New risk-based safety standard;
- Increased public transparency for chemical information; and
- Consistent source of funding for EPA to carry out the responsibilities under the new law.

For Processors, it is important to determine the TSCA Inventory status of the chemicals that they import, use, and produce. Frequently TSCA Inventory status can be found on Safety Data Sheets. Chemicals that are used by processors should either be TSCA listed or meet an exemption or exclusion that allows the chemical not to be TSCA listed.

Under Amended TSCA, the TSCA Inventory will be divided into Active and Inactive status. By June 2018, EPA plans the publication of the Active/Inactive substance designation of the TSCA Inventory. Chemical substances that will be listed as Active could typically be used without notification (unless there is another reason requiring reporting such as SNUR). Chemical substances that will be listed as Inactive would require a notification to the EPA 90 days prior to the anticipated date for resuming manufacturing or processing.

Most items manufactured by polyurethane processors are articles. Under Amended TSCA, articles potentially could be subject to less regulation than chemical substances.

According to 40 CFR 704.3, an article means a manufactured item

i. which is formed to a specific shape or design during manufacture,

ii. which has end use function(s) dependent in whole or in part upon its shape or design during end use, and

iii. which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the article, and that result from a chemical reaction that occurs upon end use of other chemical substances, mixtures, or articles; except that fluids and particles are not considered articles regardless of shape or design.

These items are considered articles (TSCA Chemical Data Reporting Fact Sheet: Articles, U.S. Environmental Protection Agency, August 3, 2012):

1. Transformers (including contained transformer fluid); cigarette lighters (including contained lighter fluid), automobiles (including contained crankcase oil), desiccant packets (including the contained silica gel beads). The chemical substances or mixtures contained in these articles are not intended to be removed from that article and have no intended end use or commercial purpose separate from the article. While the substances contained in the articles would not themselves be articles if they were separately imported in bulk, they are considered part of the overall imported article in these instances.

2. Metal or plastic sheets, wire, coated fabric, rolled carpet, and sheets of plywood. These items are articles if they are manufactured (or imported) in a specific shape or design for a particular end use application, and this design is maintained as an essential feature in the finished product. These items will still retain their "article" status even if subsequent to manufacture (or import) they are rolled or drawn thinner, cut, printed, laminated, drilled, welded together, polished, buffed, or thermoformed, as long as they meet the above criteria. Note, for coated fabrics and other similar products that are treated or coated, EPA recognizes that the coating may be removed or released throughout the life of the product (e.g., washing, handling). The substance still retains its article status in these situations as the removal and release is not "intended" and serves no end use function.

3. Thermoformed plastics. If a plastic sheet is thermoformed (molded) into a plastic box, the characteristic shape of the plastic sheet is essentially maintained by virtue of the flat, rectangular sides and bottom of the box, even if the thickness of the sheet is somewhat changed. The sheet can in this case still be considered an article.

4. Molded plastic parts, machined metal parts, finished pipes, and other finished construction materials. These items are part of an article manufactured (or imported) to a specific shape or design for end use.

5. Batteries, radioactive materials in detectors. These items undergo changes of

composition which have no commercial purpose separate from that of the article.

These items are not considered articles (TSCA Chemical Data Reporting Fact Sheet: Articles, U.S. Environmental Protection Agency, August 3, 2012):

1. Ink in pens, caulk in canisters, substances or mixtures in aerosol cans, lighter fluid in refill cans. While these substances or mixtures are contained within an article at the point of import, they are intended to be removed from that article and have an end use or commercial purpose separate from the containing article.
2. Metal ingots, billets, blooms, sheets, or other bulk metal raw material. The shape of these items does not serve a function with respect to the item's end use (i.e., it is imported in a particular shape for the sake of shipping convenience). They are typically processed in a way that results in a significant change from the original shape upon import. Blocks of plastic or other bulk plastic shapes that are imported and converted into finished plastic articles through extrusion, injection molding, or other converting processes are also not considered articles.
3. Articles that have been previously disposed of and are now being imported for reclamation of specific chemical substance or for conversion into a new form, such as scrap metal, electronics, metal fixtures. These items do not have end use function dependent in whole or in part upon their shape or design during end use.
4. Imported paints, inks, powder coatings, adhesives, and other chemical substances or mixtures that are in fluid or particulate form. Items which consist of fluids and/or particles are not article.
5. Imported solid articles which contain chemical substances or mixtures that change to a fluid or particle form or are intended to be released during end use of the article are not eligible for the article exemption. Examples include, but are not limited to, crayons, grease pe ns, soldering wires, and welding rods.

APPENDIX II
HAZWOPER TRAINING REQUIREMENTS

In addition to the HAZCOM standard discussed in Section 5 of the this MOCA Use Guidance document, a higher level of hazard training may be required of employees under OSHA's Hazardous Waste Operations and Emergency Response ("HAZWOPER") standard set forth at 29 CFR 1910.120. Depending on facility-specific conditions and practices, the HAZCOM standard may not cover all the foreseeable exposures for employees at a particular facility where MOCA is used. There are some potential exposures, such as those that may be experienced by a "first responder," that may result in an employer being regulated under the more rigorous HAZWOPER requirements.

There has been some debate among industry representatives and regulators with respect to when the workplace conditions warrant training beyond the HAZCOM standard and when the HAZWOPER standard must be applied.

1. When HAZWOPER Applies

Effective March 6, 1990, the HAZWOPER rule regulates employers and employees engaged in cleanup or emergency operations where employees respond to a release or threatened release of a hazardous substance, regardless of the location of the hazard. For purposes of the HAZWOPER standard, OSHA uses the term "hazardous substances" to apply to a much larger range of materials than is associated with this same term under regulations promulgated pursuant to Section 101(14) of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA, or Superfund"). In addition to the CERCLA hazardous substances listed at 40 CFR 302.4, OSHA uses the term to include all those substances listed as hazardous by the U. S. Department of Transportation at 49 CFR 172.101 (and appendices), all listed and characteristic hazardous wastes, and any "biological agent or disease-causing agent." Therefore, this standard applies to a release or a substantial threat of a release of MOCA. Examples of potential MOCA releases may include a spill during shipping or receiving, storage container failure, forklift accidents, or a major release from production process equipment.

Not every release of hazardous substances creates a safety hazard or emergency exposure condition. Responses to releases of hazardous substances where there is no potential safety or health hazard (such as no risk of a fire, chemical exposure, or oxygen deficiency) are not considered to be emergency responses.

The HAZWOPER standard also does not apply in situations where there is an incidental release of hazardous substances, but where the released substance can be absorbed, neutralized, or otherwise controlled at the time of release by the employees in the immediate release area. This type of situation is not considered an "emergency response" within the meaning of the HAZWOPER regulations [29 CFR 1910.120(a)(3)].

The regulations require employers to prepare an emergency response plan addressing the release or threat of release of each hazardous substance, such as MOCA, as well as to provide ongoing response training for their employees. The final regulations were published in 54 Fed. Reg. 9294 (March 6, 1989).

If the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards, then the rule does not apply. The dermal contact and inhalation concerns associated with MOCA must be evaluated when making this determination. If the polyurethane processor determines that the rule does not apply, the basis for this conclusion should be well documented and maintained on file. For those workplaces that are covered, the rule requires specific response procedures and employee training for those employees involved in the response.

Some employers have interpreted the regulations to provide that, where the efforts of one employee are adequate to respond to the emergency condition or release, the HAZWOPER requirements do not apply, but OSHA refutes this interpretation. Rather, federal OSHA regulations provide that where employees from outside the immediate release area conduct the response effort, the HAZWOPER requirements apply. For example, under the rule, where a maintenance department employee is assigned to go to the area of the release, either to perform defensive, spill containment tasks, or to attempt to shut down the release, the HAZWOPER standard applies.

For example, an employee designated to enter an area to shut off a leak in the event of a

release would be considered under OSHA regulations as a "first responder" subject to HAZWOPER regulations. Members of hazardous materials ("HAZWOPE") team assigned to respond to a release in a chemical storage area are also regulated under the HAZWOPER standard.

The HAZWOPER standard is actually a series of standards. The HAZWOPER requirements provide for several levels of employee training, depending on the activity and the potential exposure, ranging from 8-hours of training to 40-hours [29 CFR 1910.120(e)]. The levels of training are described in greater detail below.

a. Employee Teams and Outside Responders

Given the potential for emergency conditions at most polyurethane manufacturing facilities, managers have a responsibility to prepare a plan for reacting to hazardous materials emergencies. The first decision is whether the company will maintain its own response team or rely on qualified outside responders.

The employer does not have to comply with the HAZWOPER requirements if the employer's plan includes all the following:

- Evacuation of all employees from the area
- Prohibits employees from assisting in the handling of the emergency
- Provides an OSHA Emergency Action Plan under 29 CFR 1910.38(a)

Where the company elects to maintain its own team of responders, management has the responsibility to decide whether to perform in-house training, seek outside training, or provide a combination of internal and external expertise in the training of responders. The final rule makes clear that all employers with 10 or more employees, who have at least one employee that is expected to be involved in emergency response, must prepare **emergency response plans,** and provide adequate **training** for the employees responding.

Where the rule applies, the written emergency response plan should include such things as pre-emergency planning and coordination with outside parties, lines of authority, training, emergency shutdown, evacuation, procedures for controlling the emergency, employee alarm system, development of evacuation procedures and communication. In addition, it should include safe distances and places of refuge as well as emergency alerting procedures and emergency medical treatment.

Local or state emergency response plans may be substituted into the employer's plan to avoid duplication. In addition, a separate emergency response plan is not required if the employer has already prepared an emergency response plan for handling releases of hazardous substances in accordance with the Emergency Planning and Community Right-to-Know Act of 1986 and it is on file with the local emergency planning committee.

For in-house training, OSHA regulations require that management provide an effective and comprehensive training program. Equipping and training an emergency response team is costly and time consuming. The greatest benefit gained by having an in-house response team is the short time frame needed to respond.

An employee who will participate or be expected to participate in an emergency response will need training in accordance with his role at the site. Each hazardous substance present at the facility has a unique set of chemical and physical properties that may present

health or safety hazards. The best response to the release of a unique chemical is a response plan in the form of a Standard Operating Procedure, and effective training will ensure that the assigned employees will implement the procedure that has been tailored to the emergency.

The appropriate level of training depends on several factors. Under the HAZWOPER standard, there are five levels of training that may be required, as follows

Level 1: First Responder Awareness

This level of training includes individuals who "witness or discover a release of hazardous materials and are trained to notify the proper authorities." Most employees can operate at the "awareness" level because no training beyond the Hazard Communication Standard is required where the experience of the employee demonstrates competency. Of course, for an employee new to the processes, materials or hazards, some awareness training will likely be necessary, and it may be in the best interest of the facility to provide additional training for all employees who are required under OSHA regulations to have Level 1 awareness.

Level 2: First Responder Operations

This training level applies to those employees designated to respond to the release of hazardous substances. For this level, the response is in a defensive mode (such as spill containment) and does not extend to taking steps to stop the release. Though not clearly mandated under the regulations, a minimum of eight hours of initial training is typically warranted in such situations.

Level 3: Hazmat Technician

A hazardous materials ("hazmat") technician is an employee who is designated to respond aggressively to stop the release of hazardous substances. "A minimum of 24 hours of Level 2 training and demonstrated experience in specific competencies" are required. In practice, the hazards presented to an aggressive responder as a hazmat technician are so significant that seldom will such an employee be able to receive ample preparation in 24 hours of training. The requirement for 24-hours of training is a minimum, and an employer will be held to provide training adequate to prepare the hazmat technician to meet the threat.

Level 4: Hazmat Specialist

A hazmat specialist requires "24 hours of Level 3 and proven experience in specific competencies." Normally, this level of training is not essential to an in-house team, and hopefully facility employees have seldom had an opportunity to gain actual emergency response experience.

Level 5: On-Scene Incident Commander

The on-scene incident commander "assumes control of the incident scene beyond the first-responder awareness level." The commander trains for a minimum of 24 hours at Level 2 with *additional* competencies (e.g., selecting the proper protective equipment).

The employer must certify that the employees have the amount of training or experience required by the rule. This does not require the submission of paperwork to OSHA. However, during inspections, OSHA officials will interview employers and employees to

determine if they have been adequately trained. In addition, the employees must also receive annual refresher training or demonstrate yearly their competency in the various areas.

After evaluating the costs of an in-house team and the risks to employees, many managers of polyurethane manufacturing facilities elect to make contractual arrangements in advance with qualified outside teams to respond to emergency hazardous substance releases. In addition to training, an effective team of in-plant responders will require special equipment. Typically, a minimum of two self-contained breathing apparatus ("SCBA") and two Class 1 (chemical protective) suits are required to be available to a team of two on-site responders trained to Level 3 as hazmat technicians.

The use of this equipment must be part of the training. For example, Class 1 suits are air- tight and responders wearing these suits may need to cut their way out if the air supply fails.) It is generally required for each employee assigned as an emergency responder to be examined by an emergency medical technician, who must then certify that no abnormal medical conditions are evident.

2. Preparing to Respond

Other important steps to be taken in preparing to respond to an emergency release of hazardous substances include becoming familiar with the capabilities and procedures of the public responders in your area, typically the fire departments. Invite them to become familiar with the layout, material storage locations and other features of your facility. Often, the public responders may be willing to train at your site and may allow your team of awareness-level or other responders to train on-site with them.

If facility management has decided to contract with an outside emergency response team, we recommend contracting with the private hazmat companies well in advance of any emergency. Having more than one response company to choose from minimizes the chance that your responders will be busy at another emergency and unavailable when you need them.

3. Multiple Safety Provisions

Finally, whether a situation involves HAZCOM or HAZWOPER, more than one OSHA safety standard may apply. There will typically be applicable provisions in the general standards for industry (29 CFR 1910), there may be safety requirements that are specific to a given activity or circumstance (such as torch cutting or forklift beacons), and when compared, these provisions may be found to provide different requirements for the employer and different levels of protection for the employee.

As a national policy, OSHA has announced two general rules of interpretation which the Agency will apply to determine which safety standard the employer should have applied. These two rules of interpretation are as follows:

1. Any standard is *specifically* applicable to a condition, practice, means, method, operation, or process, then that standard shall prevail over any different *general* standard which might otherwise be applicable to the same condition, practice, means, method, operation, or process [29 CFR 1910.S(c)(l)].

2. In the event of a conflict or overlap of OSHA provisions, the provision that is *more protective* of the employee's safety and health shall be deemed to apply, even where

another provision is more specifically applicable [29 CFR 19 I 9. I 20(a)(2)(i)].

Polyurethane manufacturers should review the facility's emergency contingency plan or other employee assignments to identify any employee duties that may include exposures covered by the HAZWOPER standards and determine the appropriate level of training and protection for each such covered employee.

4. Duplicative Training

With the promulgation of overlapping training requirements, such as the requirements by the DOT for training related to safe transportation of materials, the issue has been raised whether the DOT/OSHA/EPA rules regarding training are duplicative requirements and whether training provided for one agency's requirements may be used to satisfy another agency's training requirements.

Each agency has adopted a policy that training performed to satisfy another federal agency's requirements may be used to satisfy the requirements of all, depending upon the nature and extent of that training. Duplicative training is <u>not</u> necessary when the requirements of the three agencies are met by training received in a comprehensive program. Each processor should tailor its hazardous materials and substances training programs to comply with all three federal requirements using a single training session wherever practicable.