POLYETHER POLYOLS PRODUCTION

PRESUMPTIVE MACT

Introduction

In 1994, the EPA had to postpone work on several of the maximum achievable control technology (MACT) standards due in November 1997 and November 2000 (the 7-year and 10-year MACT standards) as a result of resource constraints. If the EPA fails to set MACT standards on time, Section 112(j) of the Clean Air Act (Act) requires the States to establish emission limitations using a case-by-case determination of what the Federal standard would have been. Case-by-case MACT determinations under 112(j) will require substantial information and resources from State and local agencies, industry, and environmental groups, and there appears to be a strong incentive for all parties involved to gather information for 112(j) determinations and to promulgate standards on time. The amount of work needed to complete all of the 7-year and 10-year standards on time is difficult to predict; however, the EPA believes that new approaches are needed to reduce the amount of work and time associated with standards development. To achieve this goal, the EPA has initiated a new standard setting process called MACT Partnerships, which involves a partnership between States, industry, and environmental organizations. This process is described in the March 29, 1995 Federal Register.

The MACT Partnerships program involves two phases. The first phase involves the development of a “presumptive MACT.” A presumptive MACT (P-MACT) is not an emission standard; it serves as a statement of current knowledge of maximum achievable control technologies and a basis for a decision on how to develop the emission standard for the source category involved. The second phase is the formal standard development process. For the second phase, the EPA envisions the use of one of three basic regulatory development paths: adopt-a-MACT, share-a-MACT, or a streamlined-traditional approach. In all cases, the EPA would eventually propose and then promulgate the MACT standard.

The adopt-a-MACT and share-a-MACT paths involve agreements with States and industry to take primary or shared responsibility for developing the underlying data and analyses from which EPA would determine MACT. When no suitable partners can be found, or a standard appears suitable for development by the traditional process, the EPA would go through a “streamlined-traditional” process of rule development.

The EPA collected process and emissions information on the polyether polyols source category as a result of this MACT partnership with industry and State regulatory agencies. This information was the starting point for the development of P-MACT. Because some of the emission points in the polyether polyols industry are similar to those in the organic chemical industry, the Hazardous Organic NESHAP (HON) was used as a reference in developing some of the provisions in this P-MACT. The HON was promulgated on April 22, 1994 (59 FR 19402). The EPA obtained additional input to determine P-MACT from the P-MACT Roundtable which consisted of representatives from the Louisiana Department of Environmental Quality, West Virginia Office of Air Quality, Texas Natural Resource Conservation Commission, Society of the Plastics Industry, and polyether polyol manufacturing companies.

On November 13, 1995 and February 8 and 23, 1996, roundtable meetings were held among all interested parties to obtain feedback on the preliminary P-MACT. Some of the comments made during the roundtable meetings have been incorporated into this document, while others will require additional research before they can be resolved. The purpose of this document is to present P-MACT guidance for the polyether polyols source category, and to describe issues that need to be resolved before proposal and final issuance of a standard. To provide interested parties with the most current information on the polyether polyols MACT standard, this document will be updated as new information is obtained and outstanding issues are resolved.

The Agency wishes to emphasize that this is a guidance document and does not represent a final Agency decision on the emissions limitations that will apply in the MACT standard when it is issued. The EPA has not completed all of the administrative requirements necessary to issue a standard for this category. This P-MACT guidance is intended to assist State permitting authorities or EPA Regional Offices as they develop case-by-case MACT determinations under either §112(g) or §112(j) of the Act. This document should not be treated by EPA, States, or regulated facilities as establishing definitive requirements that must be followed in all cases.

There are two primary components of the P-MACT process. The first is the development of emission and implementation provisions for the industry, based on the available information. The second is a list of issues that need to be addressed before proposal of a standard.

I. P-MACT EMISSION AND IMPLEMENTATION PROVISIONS

A. Source Category Definition

For purposes of P-MACT, the source category includes any polyol production facility that is a major source, or is located at a major source plant site. Polyether polyols are defined as the products formed by reaction of ethylene oxide (EO), propylene oxide (PO), or other cyclic ethers with compounds having reactive hydrogens (i.e., -XH, where X = N, S, O, P, etc.). This definition excludes materials regulated as glycols or glycol ethers under the Hazardous Organic NESHAP (HON). A major source is any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit[1] considering controls, in the aggregate, 10 tons per year of any hazardous air pollutants (HAP) or 25 tons per year of any combination of HAP. At this time, the definition of this source category will not include polyethers that are manufactured by reacting cyclic ethers with a compound having only one reactive hydrogen. However, the EPA **will investigate** these compounds after P-MACT development and will determine if they should be incorporated into the MACT standard before proposal.

Most polyether polyols production involve the handling of HAP in two main areas: the polymerization reaction area and the polyol purification area. Polyols polymerization may use HAP as the reactive-hydrogens compound (i.e., the "initiator" or "starter", usually ethylene glycol or propylene glycol), the cyclic ethers (e.g., EO or PO), and/or the reaction solvent. Some of these HAP are still present in the polyol purification process, along with any new HAP that may be introduced as a finishing solvent (toluene and hexane are the predominant HAP solvents used in catalyst recovery processes). No HAP is believed to be formed from the polymerization reaction.

B. Applicability/Primary Product Determination

The definition of primary product as outlined in section 63.480(f) of the Polymer and Resins I NESHAP 40 CFR 63, subpart U, is being adopted for this P-MACT and is presented below.

Primary product determination and applicability

[1] NOTE: The "potential to emit" portion of the §112 General Provisions is currently undergoing Agency review and may be redefined in the near future. Any changes will be equivalently reflected in this P-MACT.

The Primary product of a process unit shall be determined according to the procedures specified in paragraphs (f)(1) and (f)(2) of this section. ...

(1) If a process unit only manufactures one product, then that product shall represent the primary product of the process unit.

(2) If a process unit designed and operated as a flexible operation unit, the primary product shall be determined as specified in paragraphs (f)(2)(i) or (f)(2)(ii) of this section based on the anticipated operations for the 5 years following **[insert promulgation date]** for existing affected sources and for the first 5 years after initial start-up for new affected sources.

(i) If the flexible operation unit will manufacture one product for the greater operating time over the five year period, then that product shall represent the primary product of the flexible operation unit.

(ii) If the flexible operation unit will manufacture multiple products equally based on operating time, then the product with the greatest production on a mass basis over the five year period shall represent the primary product of the flexible operation unit.

C. Presumptive MACT for the Production of Polyether Polyols Using Ethylene Oxide, Propylene Oxide

Table 1 presents the presumptive MACT emission provisions for production of polyether polyols using EO or PO. Following the table is a more detailed description of the process vents emissions provisions.

Table 1. Production of Polyether Polyols Using Ethylene Oxide or Propylene Oxide Polyols P-MACT Emission Provisions Summary

Emission Source	P-MACT Emission Provisions
Storage Tanks	HON control technologies used on applicable storage vessels. Applicability is determined using the HON vapor pressure and capacity cutoffs.
Process Vents EO and PO emissions:	Reduce process vent emission of EO and PO by an overall 98 percent by weight, or each stream to a concentration less than 20 parts per millon (ppm).
Other HAP emissions from the reaction and purification areas:	The EPA was unable to determine a P-MACT floor for other HAP at this time. Therefore, P-MACT does not include provisions for other HAP, but provisions will be established for MACT.
Equipment Leaks	HON, 40 CFR 63, subpart H.
Wastewater	HON reference control technology for applicable streams using the HON applicability criteria.

Process Vents P-MACT

The emissions provisions for P-MACT for facilities that emit EO or PO was a value proposed by the industry trade association (The Society of the Plastics Industry (SPI)). The P-MACT emissions provisions of an overall 98 percent reduction or concentration less than 20 ppm will be achieved by a control device.

A control device is defined as any equipment or process control that is used for capturing, recovering, or oxidizing organic HAP. Such equipment includes, but is not limited to absorbers, adsorbers, boilers, condensers, flares, incinerators and process heaters, or any combination

thereof. Source reduction/pollution prevention techniques, such as complete reactions (i.e., "cook-out") will also be considered control devices. Condensers operating as reflux condensers that are necessary for processing, such as liquid level control, temperature control, or distillation operation, shall be considered inherently part of the unit operation and will not be considered control devices.

The EPA will investigate the accuracy of this P-MACT emissions requirement, and determine whether emission reductions from cook-out can be calculated as a control option. This latter point is not a trivial issue, as six of the 12 EO/PO facilities in the database report using cook-out as a control option. Additionally, the EPA believes that the emission reduction potential for a cook-out can vary greatly depending on the duration of the reaction extension and the specific reaction kinetics associated with the polyol being produced.

Storage Tanks P-MACT

Since the storage P-MACT provisions represent the results of a MACT floor analysis, it is exempt from consideration of costs. However, members of the Roundtable asked whether the HON limits would be cost effective for some of the more common organic HAP being stored and used in polyether polyols production: toluene, hexane, PO, and EO.

In response, storage control cost effectiveness can be determined by applying the AP-42 emission equations with the same costing analysis and effectiveness cutoff ($3000/Mg) as the HON, but the result can vary depending on the annual amount of turnovers that are assumed. Consequently, we performed cost effectiveness calculations for the two HON capacity cutoffs using a range of turnover rates. For toluene, HON control technologies were determined to be ***NOT*** cost effective at either capacity cutoff, except in the case of a very large number of turnovers. Likewise, having a vapor pressure of 3.1kPa (assuming 70^{o}F storage temperature), toluene storage would not require controls if we were to apply the HON vapor pressure cutoffs. For hexane (vp=16.8kPa at 70^{o}F), PO (60.4 kPa), and EO (151 kPa), HON controls were determined to be cost effective at both capacity cutoffs, which would also be consistent with applying the HON requirements to these three chemicals. Of course, polyol producers who store EO and PO under pressure (i.e., $\geq$204.9 kPa) would be exempt from further requirements by the HON as long as they do not emit HAPs from their pressure vessels. Thus, for each of these four chemicals,

the HON capacity/vapor pressure cutoffs serve as a good measure of cost effectiveness for typical polyether polyol production storage tank scenarios.

D. Presumptive MACT for Tetrahydrofuran (THF) Polymerized Polyols

Table 2 presents the presumptive MACT emission provisions facilities that polymerize THF.

Table 2. Presumptive MACT Emission Provisions for Facilities that Polymerize THF

Emission Source	P-MACT Emission Provisions
Process Vents Continuous Vent Streams	• The HON process vent provisions reference control technology will be required for applicable sources. The HON resource effectiveness equation will be used to determine applicability.
Batch Vents	• The control devices described above will be required for applicable sources. The Batch ACT cost-effectiveness equation at 90 percent control efficiency will be used to determine applicability. This is consistent with the approach used for EO/PO polyols, because equipment that is inherently part of the unit operation cannot be counted in accomplishing the 90 percent reduction.
Storage Vessels	• HON control technologies used on applicable storage vessels. Applicability is determined by calculating the cost effectiveness of controlling the vessel using AP-42 to calculate emissions and the HON BID (Vol. 1B, Appendix C & E and Vol. 1C, Appendix C) to calculate the annualized cost of the control technology. The calculated cost effectiveness is compared to a ceiling value of $3000/megagram(Mg) of emissions reduction, based on the HON base year. If the calculated cost effectiveness is less than or equal to $3000/Mg, then a control is required.
Equipment Leaks Continuous and Batch Service	• HON, 40 CFR 63, subpart H.
Wastewater	• HON reference control technology for applicable streams using the HON applicability criteria.

E. General P-MACT Implementation Provisions

The general P-MACT implementation provisions are to basically follow 40 CFR Part 63, subpart A (General Provisions for the Clean Air Act, Section 112). These provisions are summarized in Table 3.

Table 3. P-MACT Implementation Provisions

Implementation Aspect	P-MACT
Recordkeeping	• Records may be maintained electronically, in hard copy, or by another method approved by the permitting agency • Maintain records on-site for two years, and readily retrievable (i.e., accessible within 24 hours) for a period of five years • Submit verification that the technology is installed and is operating properly (e.g., monitoring data, calibration checks, start-up, shutdown, and malfunction records)
Reporting General (from General Provisions)	• Initial notification • Construction/reconstruction reports • Source test reports • Initial notification of compliance status
Semi-annual reports	• Notification of violations/exceedances • Start-up, shutdown, and malfunction reports
Annual reports	• Notification of compliance status, including report of HAP emissions
Monitoring Add-on controls and/or Cook-out	• Continuously monitor performance during operation - facility establishes monitoring plan in accordance with general guidelines
Compliance Period	• Annual emission limitation, calculated on a monthly basis

II. ISSUES IDENTIFIED IN THE P-MACT PROCESS

In the P-MACT process, several issues and action items were identified which will be investigated by the EPA during the development of the MACT standard. These are outlined in the following section. The EPA will continue to work on the MACT standard, with a particular emphasis on resolving issues related to these areas, as identified by the P-MACT Roundtable.

- The industry will provide additional data to support dividing the polyols production source category, as suggested in the SPI letter dated February 20, 1996. Upon receipt of said information, the EPA will assess the emission characteristics of producing the range of polyol compounds and will determine whether subdividing the source category would be prudent.

- In order to support a MACT standard based on emission reduction, the emission reduction from extending the reaction (i.e., cook-out) must be determined. State Agency and industry input is being requested.

- The EPA will further evaluate the emission reduction provision for EO and PO.

- The EPA will investigate a MACT emission reduction (or limitation) provision for HAP other than EO and PO.

- Industry representatives described a process where the polyols are modified after they are produced. It was explained that this process can occur at the manufacturing site or off-site at the customer's facility, and may or may not use HAP. The EPA will gather data on this modification process and determine if these emissions should be included in a MACT regulation for polyether polyols production.

- One facility reported zero process emissions from their polyol production process. It is believed that this facility is a very well controlled facility. The EPA will follow up with this facility to determine if their estimate is accurate.

- The EPA will investigate the need to expand the source category to include polyols made using compounds with a single reactive hydrogen. Industry input is requested.

- At the request of industry representatives, the EPA will investigate a facility-wide emissions exemption level for facilities co-located at a major source site. This emissions exemption would be established based on a cost-effectiveness calculation.

- The discussion of residual HAP in solid polyols that go to a dryer was presented in SPI's February 20th letter, which raised the issue of probable HAP emissions from dryer vents. Therefore, the EPA will investigate the issue of HAP emissions from the drying of solid polyols. Industry input is requested.

- Provisions for monitoring, recordkeeping and reporting will be further reviewed by the EPA. State regulatory agencies and industry input will be encouraged.

- The EPA is aware the butylene oxide (BO) is also used to manufacture polyols, but is not a HAP. The EPA does not intend to exclude those processes that use BO from the subdivision of EO/PO and THF polyols. Therefore, further investigation into polyol processes using BO will take place after P-MACT.

- The SPI raised a concern about the cost effectiveness of the wastewater P-MACT. The cost effectiveness of the HON reference control technology for wastewater was presented in the November 13, 1995 Roundtable Meeting. The overall cost effectiveness of controlling the uncontrolled HON Group 1 streams to the level of the HON was $2,310 per ton of emissions reduction. Individual facility cost effectiveness values were $3,103/ton and $2,067/ton.

- Industry has requested that the EPA examine an LDAR exemption for polyether polyol facilities having fewer than 100 components in light liquid/gas service. Industry contends that a HON LDAR program for these plants would not be cost effective.