# Economic Impact Analysis for the Proposed Polyether Polyols NESHAP

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Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Document No. EPA-453/R-97-013
May 1997

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This report is issued by the Innovative Strategies and Economics Group of the Office of Air Quality Planning and Standards of the Environmental Protection Agency.  It presents a technical analysis of the economic impacts associated with the proposed National Emission Standard for Hazardous Air Pollutants (NESHAP) for Polyether Polyols.  Mention of trade names and commercial products is not intended to constitute endorsement or recommendation for use. Copies of this report and other materials supporting the proposal are in Docket 453/R97-013 at EPA’s Air and Radiation Docket and Information Center, Waterside Mall, Room M1500, Central Mall, 401 M. Street SW, Washington, D.C. 20460. The EPA may charge a reasonable fee for copying.  Copies are also available through the National Technical Information Services, 5285 Port Royal Road, Springfield, Virginia 22161.  Federal employees, current contractors and grantees, and other non-profit organizations may obtain copies from the Library Services Office (MD-35), U.S. Environmental Protection Agency; Research Triangle Park, NC 27711; telephone number (919) 541-2777.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

# LIST OF FIGURES

# LIST OF TABLES

LIST OF TABLES (CONTINUED)

Number Page

# SECTION 1
# INTRODUCTION

Production of polyether polyols can result in the emission of hazardous air pollutants (HAP), including ethylene oxide, propylene oxide, and other oxides, as well as hydrogen fluoride, hexane, and toluene.[1] Currently, the Environmental Protection Agency (EPA or the Agency) is developing a National Emissions Standard for Hazardous Air Pollutants (NESHAP) under Section 112 of the Clean Air Act Amendments of 1990 to limit HAP emissions from the production of polyether polyols. The Agency is excluding from this rulemaking materials regulated as glycols or glycol ethers under the Hazardous Organic NESHAP (HON).[2]

Polyether polyols are a class of organic chemicals that contain multiple ether linkages (polyether) and have multiple hydroxyl groups as terminal functional groups (polyol). Figure 1 illustrates the chemical structure. Within the plastics industry, polyether polyols are classified as thermoset resins. Thermoset resins are capable of becoming permanently rigid when heated or cured. Polyether polyols are generally produced as intermediate goods; that is, they are products that are inputs into the production of other products.

Ether linkage:

```
        |               |
   -    C    -    O    -    C    -
        |               |
```

Hydroxyl group:

```
             -    O    -    H
```

where C is carbon, O is oxygen, H is hydrogen, and the dashes represent molecular bonds between the atoms of these elements in a chemical compound.

Figure 1-1. Ether Linkages and Hydroxyl Groups.

The majority of polyether polyols are used for manufacturing urethanes; other end uses include surface-active agents, functional fluids, and synthetic lubricants. This industry profile focuses on polyether polyols for urethane production. This group of polyols includes four main chemical types: polypropylene glycol, glycerin adducts of propylene oxide, other propylene oxide-based adducts, and polytetramethylene ether glycol (PTMEG).[3]

World capacity for polyether polyols for urethanes was approximately 8.5 billion pounds at the beginning of 1994. The U.S. accounted for 34 percent of 1994 world capacity. Polyether polyols are also produced in Western Europe, Japan, Canada, Mexico, the Republic of Korea, Taiwan, South America, and the People’s Republic of China.[4] In 1992, polyether polyols production represented 69 percent of worldwide capacity.[5] Over the period 1992 to 1997, consumption of polyether polyols is projected by SRI International to increase by 3.2 percent in Japan, by 2.7 percent in the U.S., and by 2.5 percent in Europe.[6]

In this report, the Agency profiles the industry, including conditions of production and supply, conditions of demand and consumption, and the organization of the industry.  The Agency then analyzes the potential economic impacts of the regulation on affected facilities.

# SECTION 2
# PRODUCTION AND SUPPLY OF POLYETHER POLYOLS

Polyether polyols are a class of polymers characterized by multiple ethers and multiple terminal hydroxyl groups. They fall into the class of thermosetting resins, or plastics. Manufacture of polyether polyols is a precursor to the production of various plastics, most notably polyurethanes. Plastics can be defined as materials comprising synthetic polymers of high molecular weight that, when shaped by flow (pressure and heat), become solid in their finished state.[7]

## 2.1 OVERVIEW OF THE PLASTICS INDUSTRY

The manufacture of plastics materials and resins is classified under SIC code 2821 as part of the Chemicals Industry, SIC code 28. In 1987, the value of shipments of plastics materials and resins constituted 13.2 percent of the value of shipments for the chemical industry and 34 percent of the value of shipments for the plastics industry.[8] The plastics industry also includes the next manufacturing step, compounding or formulating, followed by processing, which converts plastics materials into usable products or forms. Processed plastics products are classified as Miscellaneous Plastics Products (SIC 3080), within the Rubber and Miscellaneous Plastics Products industry, SIC 30.

Manufacture of plastic products is basically a three-step process. First, the basic resin or polymer is produced from various chemical compounds; this process is called synthesis. Then, the resin is mixed with other materials to produce an intermediate compound with particular characteristics; this is called formulation. Third, in the processing step, the plastics compounds are processed into products or forms by using heat and/or pressure. Plastics materials are obtained from about 300 basic material suppliers operating nearly 500 plants and 175 independent compounders/concentrators. Processing is done by

- facilities of manufacturers of other end products (59 percent of total volume),
- independent processors of proprietary and custom products (36 percent), and
- basic materials suppliers and suppliers of plastics processing equipment (5 percent).[9]

Figure 2-1 shows the relationship between plastic polymer producers, compounders, and processors.[10]

Polyether polyols are produced in the first, basic production step of the production process. As noted above, the production of polyether polyols is part of SIC 2821, Plastics Materials and Resins. Table 2-1 shows historical data on the production of this SIC code.[11]

## 2.2 MATERIAL INPUTS

Polyether polyols are manufactured by reacting a cyclic ether with an initiator. The cyclic ether is generally

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Figure 2-1. The Plastics Manufacturing Industry.

ethylene oxide, propylene oxide, or tetrahydrofuran. The initiator may be water, propylene glycol, ethylene glycol, glycerin, trimethylolethane, trimethylolpropane, or other materials.

## 2.3 PRODUCTION PROCESSES

Polyether polyols are manufactured through chemical reactions in which cyclic ethers (oxides), such as ethylene oxide, propylene oxide (PO), or tetrahydrofuran (THF), react with active hydrogen-containing compounds (initiators), such as glycerine, water, or ethylene or propylene glycol, in the presence of a base catalyst such as potassium hydroxide. A

TABLE 2-1. EMPLOYMENT AND PRODUCTION IN THE PLASTICS MATERIALS AND RESINS INDUSTRY (SIC 2821)

| Year | Employment ($10^3$) | Value of Shipments ($\$10^6$) |
|---|---|---|
| 1977 | 57.2 | 10,818.2 |
| 1978 | 57.6 | 11,997.5 |
| 1979 | 60.3 | 14,282.4 |
| 1980 | 58.8 | 14,908.2 |
| 1981 | 57.7 | 16,675.5 |
| 1982 | 54.7 | 15,769.2 |
| 1983 | 53.2 | 18,935.8 |
| 1984 | 54.2 | 20,776.3 |
| 1985 | 55.4 | 20,261.8 |
| 1986 | 54.7 | 21,483.7 |
| 1987 | 56.3 | 26,245.5 |
| 1988 | 58.3 | 32,109.8 |
| 1989 | 62 | 33,256.7 |
| 1990 | 62.4 | 31,325.8 |
| 1991 | 60.5 | 29,565.8 |
| 1992 | 60.4 | 31,303.9 |

Source: U.S. Department of Commerce. 1992 Census of Manufactures. Industry Series. Industry 2821, p. 28.

wide variety of compositions of varying structures, chain lengths, and molecular weights is theoretically possible.[12]

Polyether polyols can be subdivided, based on the cyclic ether from which they are made, into two groups: polyols based on PO and polyols based on THF. Polyether polyols based on PO are produced by chemical reactions of PO with an initiator compound having active hydrogen groups (e.g., -OH or -NH where O is oxygen, H is hydrogen, and N is nitrogen), in the presence of a base catalyst. The initiator used depends on the type of polyurethane that the polyol will be used to produce. Typically, the reaction is carried out by discontinuous batch processes, at elevated pressures and temperatures, and under an inert atmosphere. When the desired degree of polymerization has occurred, the catalyst is neutralized and filtered out. Then the polyol is purified and desired additives are incorporated. Types of polyether polyols based on PO include polypropylene glycol, polyol adducts, block copolymers, polyurea polyols, and polymer polyols.

Polytetramethylene ether glycol (PTMEG) of different molecular weights is manufactured by the polymerization of THF using a Lewis acid catalyst. PTMEG may be a liquid or a waxy solid, depending on its molecular weight. PTMEG is used to manufacture polyurethane elastomers and spandex fibers.

## 2.4 NATIONAL OUTPUT OF POLYETHER POLYOLS

Seventy-nine facilities in the United States produce polyether polyols. Of the 79 facilities, 72 are anticipated to be impacted by the regulation. Data from the Society of the Plastics Industry (SPI), shown in Table 2-2, indicate that more than 2.1 billion pounds of polyether polyols were produced in the U.S. in 1993.[13]

Over the 10-year period shown in the table, domestic U.S. production of polyether polyols increased from approximately

TABLE 2-2. PRODUCTION OF POLYETHER POLYOLS, 1983-1993

| Year | Production of Polyether Polyols ($10^6$ lbs.) |
|---|---|
| 1983 | 1,296 |
| 1984 | 1,347 |
| 1985 | 1,391 |
| 1986 | 1,452 |
| 1987 | 1,626 |
| 1988 | 1,872 |
| 1989 | 1,808 |
| 1990 | 1,788 |
| 1991 | 1,769 |
| 1992 | 1,838 |
| 1993 | 2,144 |

Source: Society of the Plastics Industry. Facts & Figures of the U.S. Plastics Industry. Washington, DC, Society of the Plastics Industry. 1994. p. 52.

1.3 billion pounds per year to approximately 2.1 billion pounds, an increase of approximately 65 percent.

## 2.5 POLYETHER POLYOL PRODUCTION FACILITIES

The EPA has identified 79 facilities in the U.S. that produce polyether polyols and will be affected by the regulation. Of the 79 facilities producing polyether polyols, 7 have been determined by the Agency to be area sources and these facilities will not be affected by the rule. For this reason, these facilities are omitted from the industry profile and impacts analysis contained in the remainder of this report. Table 2-3 lists these facilities by model plant category. The category or categories of polyether polyols produced at each plant, defined in terms of demanding sector are also shown in Table 2-3.

## 2.6 ESTIMATED DOMESTIC PRODUCTION OF POLYETHER POLYOLS IN 1996

Data for facility-specific production of polyether polyols are generally not available. The Agency, with SPI, issued an Information Collection Request (ICR), that collected capacity and production data from 12 facilities. Actual production data for the 12 facilities were used to estimate annual revenues for these facilities and to estimate capacity utilization for the remaining facilities that produce polyether polyols domestically. Production capacity data were available for 17 additional facilities from the Chemical Economics Handbook (CEH).[14,15,16] Based on the capacity and production data for the 12 facilities and the production capacity data from the CEH, production was estimated for the 72 facilities producing polyether polyols in the U.S. that will be affected by the regulation. For 42 of the 72 facilities, capacity data were unavailable. The EPA assumed the median capacity for each model plant category based on the CIR and CEH capacity data available. Production estimates were derived for each model plant category using three alternative assumptions regarding capacity utilization rates: (1) randomly assigned capacity utilization, (2) mean capacity utilization, and (3) median capacity utilization. The data imputation necessary to estimate production for the randomly assigned capacity utilization approach involved the following steps:

TABLE 2-3. FACILITIES PRODUCING POLYETHER POLYOLS

| Plant | City | State | Model Plant Category | Urethane | Non-urethane | Surfac-tants |
|---|---|---|---|---|---|---|
| ABITEC | Janesville | WI | Large | | | x |
| Akcros Chemicals | New Brunswick | NJ | Large | | | x |
| Amerchol | Edison | NJ | Large | | | x |
| Arco | Channelview | TX | Large | x | | |
| ARCO | Charleston | WV | Large | x | | |
| ARCO | Institute | WV | Catalyst | | x | |
| Baker | Sand Springs | OK | Large | | x | |
| Baker | Santa Fe Springs | CA | Small | | x | |
| Baker | Dayton | TX | Catalyst | | x | |
| BASF | Washington | NJ | Catalyst | | x | x |
| BASF | Wyandotte | MI | Small | x | | |
| BASF | Spartansburg | SC | Small | | | x |
| BASF | Geismar | LA | Catalyst | x | | |
| Brin-mont | Greensboro | NC | Area | | | |
| Calgene | Skokie | IL | Small | | x | x |
| Carpenter | Pasadena | TX | Large | x | | |
| CasChem | Bayonne | NJ | Large | | | x |
| Croda | Mill Hall | PA | Catalyst | | | x |
| Dexter Chemical | Bronx | NY | Area | | | x |
| Dow | Freeport | TX | Large | x | x | |
| Dow | Midland | MI | Small | | x | |
| DUPONT | Niagara Falls | NY | Small | x | | |
| Eastern Color | Providence | RI | Large | | | x |
| Eastman | Greensboro | NC | Catalyst | x | | |
| Eastman | Conroe | TX | Catalyst | x | | |
| Emkay Chemical | Elizabeth | NJ | Area | | | x |
| Exxon | Houston | TX | Large | | x | |
| Gresco Mfg. | Thomasville | NC | Area | | | x |
| Harcros Organics | Kansas City | KS | Small | | | x |

(continued)

TABLE 2-3. FACILITIES PRODUCING POLYETHER POLYOLS (CONTINUED)

| Plant | City | State | Model Plant Category | Urethane | Non-urethane | Surfac-tants |
|---|---|---|---|---|---|---|
| Henkel | Hoboken | NJ | Large | | | x |
| Henkel | Charlotte | NC | Small | | x | x |
| Henkel | Mauldin | SC | Small | | x | x |
| Heterene Chemical | Paterson | NJ | Small | | | x |
| High Point Chemical | High Point | NC | Large | | | x |
| Hoechst Celanese | Mount Holly | NC | Large | | | x |
| Huntsman | Port Neches | TX | Small | | | x |
| Huntsman | Conroe | TX | Small | | | |
| ICI | Geismar | LA | Catalyst | x | | |
| Inolex | Philadelphia | PA | Large | | | x |
| Lonza | Williamsport | PA | Large | | | x |
| Lonza | Long Beach | CA | Small | | | x |
| Miles | Baytown | TX | Large | x | | |
| Miles | New Martinsville | WV | Catalyst | x | | |
| MIlliken | Inman | SC | Large | | | x |
| Nalco | Freeport | TX | Large | | x | |
| Nalco | Carson | CA | Small | | x | |
| Nalco/Exxon | Freeport | TX | Large | | | x |
| Nalco/Exxon | Sugarland | TX | Catalyst | | | x |
| Olin | Brandenburg | KY | Large | x | x | |
| Ortec | Easley | SC | Area | | x | |
| Petrolite | Pasadena | TX | Large | | x | |
| Petrolite Chemicals Group | St. Louis | MO | Large | | | |
| PPG | Gurnee | IL | Small | | x | x |
| QO Chemicals | Memphis | TN | Catalyst | x | | |
| Rhone-Poulenc | Winder | FL | Large | | x | x |
| Rhone-Poulenc | Baltimore | MD | Catalyst | | | x |
| Rhone-Poulenc | Spartanburg | SC | Catalyst | | x | x |

(continued)

TABLE 2-3. FACILITIES PRODUCING POLYETHER POLYOLS (CONTINUED)

| Plant | City | State | Model Plant Category | Urethane | Non-urethane | Surfac-tants |
|---|---|---|---|---|---|---|
| Sandoz Chemicals Corp | Martin | SC | Catalyst | | | x |
| Shell | Geismar | LA | Large | | | x |
| Shell | Reserve | LA | Large | | | x |
| Stepan | Anaheim | CA | Large | | | x |
| Stepan | Winder | GA | Large | | | x |
| Stepan | Fieldsboro | NJ | Large | | | x |
| Stepan | Maywood | NJ | Large | | | x |
| Stepan | MIllsdale | IL | Small | | | x |
| Stepan | Elwood | IL | Catalyst | x | | |
| Texaco (Huntsman) | Conroe | TX | Large | | x | |
| Texaco (Huntsman) | Port Neches | TX | Small | | x | |
| Union Carbide | Texas City | TX | Large | | | x |
| Union Carbide | Seadrift | TX | Small | | x | x |
| Union Carbide | Institute | WV | Small | | | x |
| Union Carbide | South Charleston | WV | Small | | | x |
| Vista Chemical | Lake Charles | LA | Large | | | x |
| Witco | Santa Fe Springs | CA | Area | | x | |
| Witco | Houston | TX | Area | x | x | |
| Witco | Harahan | LA | Large | | | x |
| Witco | Janesville | WI | Large | | | x |
| Witco | Chicago | IL | Small | | x | x |

1. Sort data for 12 facilities responding to EPA/SPI ICR according to model plant category.

2. Compute minimum and maximum capacity utilization rates in each model plant category based on the ICR data.

3. Compute randomly assigned capacity utilization rate for each facility, using the following formula:

$$[(K_{max} - K_{min})* (\text{random number between zero and one})]+ K_{min},$$

where

$K_{max}$ = maximum capacity utilization rate for facilities providing data within the relevant model plant category, and

$K_{min}$ = minimum capacity utilization rate for facilities providing data within the relevant model plant category.

4. Estimate production by multiplying randomly assigned capacity utilization rate by the productive capacity of each facility reported in the CEH.

Table 2-4 shows descriptive capacity and production statistics for facilities in the polyether polyols industry by model plant category. Production data are shown for each of the capacity utilization alternatives.

In addition to the polyether polyol production facilities identified by EPA with model plants, 7 facilities producing polyether polyols are classified as area sources. The production of polyether polyols for these facilities is estimated to range from 10 million to 30 million pounds per year. These facilities are excluded from the capacity and production statistics shown in Table 2-4.

TABLE 2-4. CAPACITY AND PRODUCTION STATISTICS BY MODEL PLANT CATEGORY

| | | | Production ($10^6$ lbs. per year) | | |
|---|---|---|---|---|---|
| | Estimated Capacity ($10^6$ lbs. per year) | ICR Capacity Utilization Rate | Randomly Assigned Capacity Utilization | Mean Capacity Utilization | Median Capacity Utilization |
| Small Model Plant Production Estimates: | | | | | |
| Number of affected facilities: 22 | | | | | |
| Minimum | 8.0 | 0.6799 | 5.4 | 5.8 | 5.9 |
| Maximum | 339.0 | 0.9039 | 305.6 | 301.0 | 301.0 |
| Mean | 60.6 | 0.8795 | 54.0 | 53.7 | 53.7 |
| Median | 50.2 | 0.8870 | 44.8 | 44.5 | 44.5 |
| Catalyst Extraction Model Plant Production Estimates | | | | | |
| Number of affected facilities: 15 | | | | | |
| Minimum | 20.0 | 0.7661 | 18.8 | 17.5 | 17.6 |
| Maximum | 210.0 | 0.8869 | 160.9 | 170.9 | 167.1 |
| Mean | 96.2 | 0.8259 | 79.2 | 73.4 | 73.8 |
| Median | 95.0 | 0.8187 | 80.7 | 72.5 | 72.8 |
| Large Model Plant Production Estimates | | | | | |
| Number of affected facilities: 35 | | | | | |
| Minimum | 95.0 | 0.6533 | 75.0 | 69.2 | 70.0 |
| Maximum | 975.0 | 0.7954 | 758.0 | 710.4 | 718.9 |
| Mean | 284.4 | 0.7286 | 207.0 | 207.2 | 209.7 |
| Median | 275.0 | 0.7374 | 198.2 | 200.4 | 202.8 |

SECTION 3

# DEMAND AND CONSUMPTION OF POLYETHER POLYOLS

The major use of polyether polyols is in the production of urethanes or polyurethanes. Although this profile focuses on the uses of polyether polyols in polyurethane production, many of the facilities affected by the proposed rule also produce polyether polyols for nonurethane uses. Other uses of polyether polyols include surfactants, synthetic lubricants, and functional fluids. Table 3-1 lists the sales and captive use of polyether polyols between 1983 and 1993.[17]

TABLE 3-1. SALES AND CAPTIVE USE OF POLYETHER POLYOLS ($10^6$ lbs.)

| Year | Flexible Foam | Rigid Foam | Nonfoam | Export | Total |
|---|---|---|---|---|---|
| 1983 | 874 | 137 | 129 | 146 | 1,286 |
| 1984 | 915 | 144 | 148 | 98 | 1,305 |
| 1985 | 1,014 | 133 | 141 | 119 | 1,407 |
| 1986 | 1,000 | 127 | 158 | 168 | 1,453 |
| 1987 | 1,045 | 144 | 188 | 276 | 1,653 |
| 1988 | 1,134 | 138 | 232 | 414 | 1,918 |
| 1989 | 1,048 | 132 | 256 | 350 | 1,786 |
| 1990 | 1,048 | 134 | 269 | 380 | 1,831 |
| 1991 | 1,016 | 136 | 253 | 392 | 1,797 |
| 1992 | 1,045 | 152 | 269 | 422 | 1,888 |
| 1993 | 1,069 | 163 | 303 | 565 | 2,100 |

Source: The Society of the Plastics Industry. Facts & Figures of the U.S. Plastics Industry. Washington, DC, Society of the Plastics Industry. 1994. p. 52.

## 3.1 PRODUCT CHARACTERISTICS

As noted above, polyether polyols are an entire class of thermosetting resins used in the manufacture of polyurethane, surfactants, lubricants, and other products. A variety of polyether polyols are used in manufacturing polyurethanes. The type of polyols chosen depends on the end use.

Polyols have different numbers of reactive hydroxyl groups, and this is referred to as “functionality.” Polyols may be difunctional, trifunctional, tetrafunctional, pentafunctional, hexafunctional, or octafunctional. The end use of a polyether polyol is determined by the properties of the polyol. Polyether polyols fall into two main classifications: high-molecular-weight, linear or slightly branched polyether polyols, and low-molecular-weight, highly branched polyether polyols. The linear or slightly branched polyether polyols are used in flexible applications, such as in flexible slab and molded foam or reaction injection molding. The branched polyether polyols are used in applications requiring rigidity, such as rigid foams.

Polyols may be combined to achieve certain desired characteristics. For example, including polymer and/or polyurea polyols in addition to polyether polyols increases a foam’s resiliency and load-bearing potential.

## 3.2 USES AND CONSUMERS

As noted above, polyether polyols are consumed mainly in the production of polyurethanes, including flexible and rigid foams. In addition, polyether polyols can be used in producing elastomers, surface coatings, adhesives, fabrics, and sealants.

The manufacture of flexible polyurethane foams is by far the largest market for polyether polyols. Within that category, the largest market is for furniture cushioning. Increasing the density of the foam to provide superior wear requires increasing the polyether polyol volume needed to produce a given amount of polyurethane foam. After furniture cushioning, passenger car seating and other transportation uses are the second largest use. Other uses include carpet padding, bedding, and packaging. Growth in the use of flexible foam is anticipated for the future, but at a relatively slow rate.

In 1993, nonfoam uses were the second largest category of consumption for polyether polyols. Nonfoam polyurethane applications include reaction-injection molded materials, widely used in the automobile industry to produce bumper covers; front- and rear-end panels; steering wheels; and other parts. Other uses include shoe soles and recreational equipment. Thermoplastic polyurethane elastomers (TPUs) are an important application of polyether polyols. These TPUs "occupy the upper end of the thermoplastic elastomer spectrum in terms of price and performance."[18] They are noted for general overall toughness and flexibility, even at low temperatures. They are resistant to abrasion, possess superior adhesive properties, are readily processable, and are very versatile. Applications of TPUs include drive couplings, the Food and Drug Administration-approved wraps for meat and poultry, and solvent-free film adhesives.[19]

The manufacture of rigid polyurethane foams is another leading use of polyether polyols. Rigid polyurethane foams are used in construction, appliances, industrial insulation, and packaging. The manufacture of rigid foams typically uses polyols with relatively high functionality (four to eight). Rigid foams are used for insulation in commercial and household refrigerators, freezers, and water heaters.

## 3.3 SUBSTITUTABILITY

The ability of manufacturers to substitute other products for polyether polyols varies from one application to another. For example, in the manufacture of rigid polyurethane foams, less expensive polyester polyols have recently been substituted for some or all of the polyether polyols in some applications. Similarly, substitutes exist for polyurethanes in some of their applications (e.g., furniture cushions, TPUs).

SECTION 4

# INDUSTRY ORGANIZATION

## 4.1 MARKET STRUCTURE

The market for polyether polyols for urethanes is international. World capacity for polyether polyols for urethanes was approximately 8.5 billion pounds at the beginning of 1994. The U.S. accounted for 34 percent of that production; Western Europe accounted for about 36 percent; Japan for 10 percent; Canada, Mexico, the Republic of Korea and Taiwan combined for 8 percent; and the rest of the world (producers located mainly in South America and the People’s Republic of China) accounted for the remaining 12 percent.

## 4.2 MANUFACTURING FACILITIES

In the U.S., 79 facilities produced polyether polyols in 1996. They are listed in Table 2-3 in Section 2. The facilities are distributed widely about the country and vary considerably in terms of size and the types of polyether polyols produced.

### 4.2.1 Locations

Table 4-1 shows the geographical distribution of polyether polyol production facilities. Polyether polyol

TABLE 4-1. POLYETHER POLYOL PRODUCTION FACILITIES BY STATE[a]

| State | Number of Facilities |
|---|---|
| California | 5 |
| Delaware | 1 |
| Florida | 1 |
| Georgia | 1 |
| Illinois | 5 |
| Kansas | 1 |
| Kentucky | 1 |
| Louisiana | 6 |
| Maryland | 1 |
| Michigan | 2 |
| Missouri | 1 |
| New Jersey | 9 |
| New York | 2 |
| North Carolina | 6 |
| Oklahoma | 1 |
| Pennsylvania | 3 |
| Rhode Island | 1 |
| South Carolina | 6 |
| Tennessee | 1 |
| Texas | 18 |
| West Virginia | 5 |
| Wisconsin | 2 |
| Total | 79 |

[a] Includes area sources.

production facilities are located in states with high concentrations of chemical manufacturers, including California, Texas, Illinois, Louisiana, New Jersey, and North and South Carolina. Texas, which has 18 polyether polyol production facilities, has approximately 25 percent of industry facilities. The next greatest concentration is New Jersey, with nine facilities, followed by Louisiana, North Carolina, and South Carolina, with six facilities each.

### 4.2.2 Employment

Employment at facilities producing polyether polyols ranges from 10 employees to 2,000 employees. Table 4-2 shows facility employment statistics by model plant category.[20]

TABLE 4-2. FACILITY EMPLOYMENT BY MODEL PLANT CATEGORY

| Employment Statistic | Model Plant Category | | |
|---|---|---|---|
| | Small | Catalyst Extraction | Large |
| Minimum | 10 | 30 | 16 |
| Maximum | 1,300 | 1,200 | 2,000 |
| Mean | 507 | 248 | 207 |
| Median | 347 | 74 | 100 |

Source: Dun and Bradstreet. Dun’s Market Identifiers. Online Database. Accessed through EPA NCC computer, FINDS System. March 1997.

### 4.2.3 Sales of Affected Products

As noted in Section 2, actual production data are available for very few of the facilities potentially affected by this regulation. The EPA therefore estimated production based on capacity data and estimated capacity utilization rate as discussed in Section 2.6 of this report. Table 2-4 shows facility polyether polyols production statistics that were estimated using three different capacity utilization rates:

- the average reported by plants in each model plant category,
- the median reported by plants in each model plant category, and
- a randomly assigned capacity utilization rate that falls between the minimum and the maximum capacity utilization rate reported by facilities in each model plant category.

Similarly, data for facility sales of polyether polyols are not available. The Agency estimated the sales (or the value of production, for facilities producing polyether polyols for captive use) by multiplying estimated production by the estimated price for polyether polyols in 1996. Polyether polyols are a class of commodities with a range of market prices. Table 4-3 shows price ranges for polyether polyols over the period 1985 through 1994.[21]

EPA estimated the August 1996 price of polyether polyols by using the midpoint of the 1994 price range ($0.96 per pound) and adjusting it to August 1996 dollars using the producer price index (PPI) for thermosetting resins.[22] The formula used to estimate the 1996 price is:

$$\$1994 \text{ price of polyether polyols} * (\text{PPI, Aug. 1996/PPI 1994}) =$$
$$\$0.96 * (157.1/143.6) = \$1.05.$$

TABLE 4-3. PRICES FOR POLYETHER POLYOLS

| Year | Price Range (cents per pound) |
|---|---|
| 1985 | 0.72 - 0.77 |
| 1986 | 0.74 - 0.81 |
| 1987 | 0.77 - 0.86 |
| 1988 | 0.76 - 0.84 |
| 1989 | 0.78 - 0.83 |
| 1990 | 0.80 - 0.85 |
| 1991 | 0.92 - 0.95 |
| 1992 | 0.89 - 0.94 |
| 1993 | 0.94 - 0.96 |
| 1994 | 0.95 - 0.97 |

Source: Chemical Marketing Reporter, various issues.

The resulting price, $1.05 per pound, was multiplied by the three estimates of facility production to yield estimated facility sales. Table 4-4 shows statistics for estimated facility sales by model plant category.

## 4.3 COMPANIES OWNING POLYETHER POLYOL FACILITIES

The 72 facilities producing polyether polyols affected by the regulation are owned by 36 companies. The companies owning these polyether polyol production facilities are of interest, because these companies will incur the costs of complying with the proposed regulation. Of particular interest is the impact of the regulation on small entities, including small companies. Small companies may have fewer internal and external sources of funds to enable them to purchase and

TABLE 4-4. ESTIMATED SALES REVENUES OF POLYETHER POLYOLS BY MODEL PLANT CATEGORY ($1996 $10^3$)

| | Random[a] | Mean[b] | Median[c] |
|---|---|---|---|
| Small Model Plant | | | |
| Minimum | $5,712 | $6,121 | $6,195 |
| Maximum | $320,972 | $316,099 | $316,099 |
| Mean | $56,727 | $56,445 | $56,448 |
| Median | $47,102 | $46,622 | $46,622 |
| Catalyst Extraction Model Plant | | | |
| Minimum | $19,776 | $18,424 | $18,522 |
| Maximum | $168,955 | $168,216 | $169,111 |
| Mean | $83,147 | $77,059 | $77,469 |
| Median | $84,761 | $76,098 | $76,502 |
| Large Model Plant | | | |
| Minimum | $78,723 | $72,692 | $72,569 |
| Maximum | $796,094 | $746,054 | $755,051 |
| Mean | $217,409 | $217,618 | $220,243 |
| Median | $208,201 | $210,426 | $212,963 |

[a] Random sales were estimated by multiplying 1996 price by estimated production, based on randomly assigned capacity utilization rate for each model plant category.
[b] Mean sales were estimated by multiplying 1996 price by estimated production, based on mean capacity utilization rate for each model plant category.
[c] Median sales were estimated by multiplying 1996 price by estimated production, based on median capacity utilization rate for each model plant category.

install capital equipment, modify operations, or undertake the other tasks that may be required to comply with the regulation. The Agency is required to analyze impacts on small businesses under the Regulatory Flexibility Act of 1982 and the Small

Business Regulatory Enforcement Fairness Act of 1996.

The general size standard definition criteria is used by the Small Business Administration (SBA) to identify the small businesses affected by this regulation. These criteria are defined by Standard Industrial Classification (SIC) code. The SBA general size standard definition for each SIC code is defined in terms of number of employees or annual sales receipts. The production of polyether polyols falls under SIC code 2821, Plastic Materials and Resins. For SIC 2821, small businesses are defined as those with fewer than 750 employees.

Data on company employment and sales were collected from Dun and Bradstreet's *Dun's Market Identifiers*, an on-line database maintained on the EPA National Computation Center computer.[23] A size distribution of affected companies is shown in Table 4-5, where size is defined in terms of employment.[24,25,26,27] A total of seven companies have fewer than 750 employees and are thus classified as small businesses according to the SBA general size standard definitions.

Table 4-6 presents a size distribution in terms of total company sales.[28,29,30,31] While the SBA defines company size for this industry is in terms of employment, company sales are of interest as a gauge of company resources for complying with the regulation. Table 4-6 demonstrates that most of the companies owning polyether polyols have substantial annual sales.

## TABLE 4-5. DISTRIBUTION OF COMPANY EMPLOYMENT

| Company Employment | Total |
|---|---|
| Fewer than 750 | 7 |
| 750 to 5,000 | 11 |
| 5,001 to 20,000 | 8 |
| 20,001 to 50,000 | 6 |
| Over 50,000 | 4 |
| | 36 |

Sources: Dun and Bradstreet. *Dun's Market Identifiers* Online Database. Accessed through EPA NCC computer, FINDS System. March 1997.

Worldscope Online database. (1995 and 1996 data) May 1997.

Disclosure Online database. (1996 data) May 1997.

Business & Co. ASAP Online database. (1995 data) May 1997.

## TABLE 4-6. DISTRIBUTION OF SALES REVENUES

| Company Sales | Total |
|---|---|
| Less than 10 million | 0 |
| 10 million to 100 million | 5 |
| 100 million to 1 billion | 9 |
| 1 billion to 5 billion | 10 |
| 5 billion to 20 billion | 7 |
| Over 20 billion | 5 |
| | 36 |

Sources: Dun and Bradstreet. *Dun's Market Identifiers* Online Database. Accessed through EPA NCC computer, FINDS System. March 1997.

Worldscope Online database. (1995 and 1996 data) May 1997.

Disclosure Online database. (1996 data) May 1997.

Business & Co. ASAP Online database. (1995 data) May 1997.

# SECTION 5
# THE POLYETHER POLYOLS NESHAP

The proposed standards regulate Hazardous Air Pollutants (HAP) emissions from polyether polyols manufacturing units (PMPU). Polyether polyols as previously defined are the products formed by the reaction of ethylene oxide (EO), propylene oxide (PO), or other cyclic ethers with compounds having one or more reactive hydrogens (i.e., a compound having a hydrogen terminally bounded with a nitrogen, sulfur, oxygen, phosphorous atom, etc.). This definition excludes materials regulated as glycols or glycol ethers under the Hazardous Organic National Emission Standard for Hazardous Air Pollutants (HON). For the proposed rule, an affected source is defined as each group of one or more PMPU and located at a plant site that is a major source.

Facilities in the source category covered by the proposed rule emit a variety of HAP. The most significant emissions are of the following HAP: EO, PO, hexane, and toluene. The proposed standards would regulate emissions of these compounds, as well as all other organic HAP that are emitted during the production of polyether polyols.

## 5.1 EMISSION CONTROLS

Emissions from the following types of emission points (i.e., emission source types) are being covered by the proposed rule: storage vessels, process vents, equipment leaks, and wastewater operations. The standards being proposed for these emission source types at new and existing facilities have the same group determination criteria and control requirements as those promulgated for the corresponding emission source types at existing sources subject to the HON. A specified emission reduction for the combination of all process vent streams within a PMPU is being proposed for process vent epoxide emissions and for nonepoxide HAP emitted from catalyst extraction. For process vents from batch unit operations that emit nonepoxide HAP from the making or modification of the product, the proposed standard requires the Group 1/Group 2 determination to be based on the criteria in the Polymer and Resins I NESHAP. In the event that there may be process vents from continuous unit operations that emit nonepoxide HAP from the making or modification of the product, the proposed standard requires the Group 1/Group 2 determination based on the criteria from the HON.

Tables 5-1 and 5-2 summarize the level of control being proposed for new and existing sources, respectively. Where the applicability criteria and required level of control is the same as the HON, this is indicated in the table as "HON." When the table lists "epoxides," it is referring to EO and PO, the HAP monomers used in the polyether polyols process. "Nonepoxide HAP" refers to organic HAP other than EO and PO that are used in the polyether polyols manufacturing process. The following sections describe these proposed standards in more detail, by emission source.

TABLE 5-1. SUMMARY OF LEVEL OF PROPOSED STANDARDS FOR EXISTING SOURCES

| Source Category Subcategory | Storage | Emission Sources | | | | |
|---|---|---|---|---|---|---|
| | | Process Vents | | | | |
| | | Epoxides | Nonepoxide HAP in making or modifying the product | Nonepoxide HAP in catalyst extraction | Wastewater | Equipment Leaks |
| Polyether Polyols made with Epoxides | HON | 98 percent aggregate emission reduction | For batch vents, the Group 1/Group 2 criteria are from the P&R I NESHAP, except that the criteria are applied to the combination of all batch vents associated with the use of an organic HAP to make or alter the product. If the collection of vents is Group 1, the requirement is a 90 percent aggregate emission reduction.<br>For continuous vents, the Group 1/Group 2 criteria are from the HON, except that the criteria are applied to the combination of all continuous vents associated with the use of an organic HAP to make or alter the product. If the collection of vents is Group 1, the requirement is a 98 percent aggregate emission reduction. | 90 percent aggregate emission reduction | HON | HON |
| Polyether Polyols made with THF | HON | NA | NA | The Group 1/Group 2 criteria are from the HON TRE equations. The control requirement is 98% emission reduction. | HON | HON |

TABLE 5-2. SUMMARY OF LEVEL OF PROPOSED STANDARDS FOR NEW SOURCES

| | | Emission Sources | | | | |
|---|---|---|---|---|---|---|
| | | Process Vents | | | | |
| Source Category Subcategory | Storage | Epoxides | Nonepoxide HAP in making or modifying the product | Nonepoxide HAP in catalyst extraction | Wastewater | Equipment Leaks |
| Polyether Polyols made with Epoxides | Existing Source HON | 99.9 percent aggregate emission reduction | For batch vents, the Group 1/Group 2 criteria are from the P&R I NESHAP, except that the criteria are applied to the combination of all batch vents associated with the use of an organic HAP to make or alter the product. If the collection of vents is Group 1, the requirement is a 90 percent aggregate emission reduction.<br>For continuous vents, the Group 1/Group 2 criteria are from the HON, except that the criteria are applied to the combination of all continuous vents associated with the use of an organic HAP to make or alter the product. If the collection of vents is Group 1, the requirement is a 98 percent aggregate emission reduction. | 98 percent aggregate emission reduction | HON | HON |
| Polyether Polyols made with THF | Existing Source HON | NA | NA | The Group 1/Group 2 criteria are from the HON TRE equations. The control requirement is 98% emission reduction. | HON | HON |

## 5.2 COSTS OF COMPLYING WITH PROPOSED EMISSIONS CONTROLS

The Agency has estimated the costs of complying with the proposed emission controls. Table 5-3 shows costs for each model plant category, and Table 5-4 shows national total costs to control the emissions.[32,33] Costs are shown for the Small Model Plant, the Large Model Plant, and the Catalyst Extraction Model Plant.

The capital and annualized costs of emission controls shown on Table 5-3 reflect control costs by emission point. The total costs for each model plant category are not shown. The reason for this is that the number of facilities requiring emission control for each emission source within a model plant category varies. For example, 20 of the Small Model Plant facilities require controls for equipment leaks, while only six require controls for process vents. Thus, the annual control costs for a facility classified as belonging to the Small Model Plant category could range from $26,100 to $89,800, depending on whether the facility requires controls on equipment leaks only or on all emission sources. Similarly, annualized costs for the Catalyst Extraction Model Plant facilities range from $72,400 to $284,100. For the Large Model Plant facilities, costs range from $50,400 to $292,500 annually, depending on whether the facility requires controls on equipment leaks only, or for all possible emission points.

In general, the economic impacts of the proposed rule are estimated assuming that each facility incurs the maximum per-plant cost for each model plant category. This is an

TABLE 5-3. ESTIMATED CONTROL COSTS BY MODEL PLANT CATEGORY

| | | Cost per Model Plant ($10^3$ $1996) | | | | |
|---|---|---|---|---|---|---|
| | | | Annual Cost | | | |
| Emission Point | Nationwide Number of Facilities Requiring Control | Total Capital Investment | Direct Cost | Indirect Cost | Monitoring, Recordkeeping, and Reporting[a] | Total |
| Small Model Plant Category | | | | | | |
| Process vents scrubber | 6 | 38.0 | 24.2 | 21.1 | 13.6 | 58.9 |
| Fixed-roof storage tanks | 5 | 16.0 | (0.25) | 3.6 | 1.0 | 4.4 |
| Equipment leaks | 20 | 52.7 | 3.0 | 17.1 | 6.0 | 26.1 |
| Catalyst Extraction Model Plant Category | | | | | | |
| Process vents (EP/PO and other-HAP) flare | 6 | 25.2 | 65.5 | 21.9 | 26.2 | 113 |
| Process vents (other-HAP only) flare | 9 | 22.4 | 50.3 | 21.5 | 21.5 | 93.3 |
| Fixed-roof storage tanks | 5 | 16.0 | (0.25) | 3.6 | 1.0 | 4.4 |
| Equipment leaks | 19 | 159 | 24.3 | 31.4 | 16.7 | 72.4 |

(continued)

[a] 30 percent of annual costs.

TABLE 5-3. ESTIMATED CONTROL COSTS BY MODEL PLANT CATEGORY (CONTINUED)

| Emission Point | Nationwide Number of Facilities Requiring Control | Cost per Model Plant ($10^3$ $1996): Total Capital Investment | Annual Cost: Direct Cost | Annual Cost: Indirect Cost | Annual Cost: Monitoring, Recordkeeping, and Reporting[a] | Total |
|---|---|---|---|---|---|---|
| Large Model Plant Category | | | | | | |
| Process vents flare | 11 | 22.4 | 50.3 | 21.5 | 21.5 | 93.3 |
| Fixed-roof storage tanks | 10 | 16.0 | (0.25) | 3.6 | 1.0 | 4.4 |
| Equipment leaks | 38 | 61.7 | 17.2 | 21.6 | 11.6 | 50.4 |
| Wastewater treatment | 6 | 416 | 34.8 | 76.3 | 33.3 | 144 |

[a] 30 percent of annual costs.

Source: Chappell, L. U.S. Environmental Pr
April 14, 1997. Revised June 30, 1997. Revised Control Costs for the Polyether Polyols Project. Tables 14, 15, and 16.

TABLE 5-4. TOTAL NATIONWIDE COST OF CONTROL FOR THE POLYETHER POLYOLS NESHAP

| Emission Point | Nationwide Costs by Model Plant ($10^3$ $1996) | | | | | | Total Costs ($10^3$ $1996) | |
|---|---|---|---|---|---|---|---|---|
| | Small | | Large | | Catalyst Extraction | | | |
| | Capital | Annual | Capital | Annual | Capital | Annual | Capital | Annual |
| Process vents | 228 | 353 | 246 | 1,030 | 353 | 1,520 | 827 | 2,900 |
| Fixed-roof storage tanks | 80 | 22 | 160 | 44 | 80 | 22 | 320 | 88 |
| Equipment leaks | 1,050 | 522 | 2,340 | 1,920 | 3,030 | 1,380 | 6,420 | 3,820 |
| Wastewater treatment | | | 2,490 | 866 | | | 2,490 | 866 |
| Total | 1,360 | 897 | 5,240 | 3,860 | 3,460 | 2,920 | 10,060 | 7,670 |

Source: Chappell, L. U.S. Environmental Protect
April 14, 1997. Revised June 30, 1997. Revised Control Costs for the Polyether Polyols Project. Table 17.

accurate estimate of costs for a subset of polyether polyol facilities only but it overstates the costs and impacts for many facilities. Given the limited amount of information available, the assumption was necessary to assure that costs were not underestimated for any facility.

# SECTION 6
# ECONOMIC IMPACTS OF THE POLYETHER POLYOL NESHAP

The Agency has estimated the impacts of the proposed polyether polyol NESHAP on both facilities producing polyether polyols and on the companies that own them. Facility impacts are being examined to assess the likelihood of facility closures and employment impacts. Company-level impacts are being examined to assess the magnitude of impacts on small businesses under the Regulatory Flexibility Act (RFA) and Small Business Regulatory Enforcement Fairness Act (SBREFA).

## 6.1 FACILITY IMPACTS

The goal of the economic impact analysis is to estimate the market response of the polyether polyols industry to the emission standards and determine any adverse effects that may result from the regulation. Since the nationwide annualized cost of this regulation of $7.7 million represents approximately 0.06 percent of the estimated 1996 sales revenues for domestically produced polyether polyols, the EPA determined that the regulation is not likely to have a significant impact on this industry as a whole. For this reason, a streamlined economic analysis was performed. The goal of this streamlined analysis was to determine whether individual facilities producing polyether polyols and companies owning those facilities are likely to be adversely impacted by the regulation. Facility-specific impacts were examined to assess the likelihood of facility closures and employment impacts.  The facility level impacts were estimated by comparing the total annual cost of control in each model plant category to estimated sales per facility resulting in a cost-to-sales ratio. A cost-to-sales ratio exceeding one percent is determined to be an initial screening criteria for a significant facility-specific impact.

Table 6-1 shows descriptive statistics for the selected impact measure, the ratio of Total Annual Cost (TAC) to Facility Sales Revenues for the 72 facilities potentially impacted by the regulation.  While the median TAC/facility sales ratio in each category is well below 1 percent, the catalyst extraction model plant category indicates a maximum ratio exceeding 1 percent.  To examine the impacts more closely, a frequency distribution of cost-to-sales ratio was developed and is shown in Table 6-2.  The three columns are the numbers of facilities incurring TAC/facility sales in each range of values, where sales are estimated based on randomly assigned capacity utilization, mean capacity utilization, and median capacity utilization, respectively.

Table 6-2 clearly shows that very few plants are significantly affected by the proposed regulation.  In addition to the 7 plants determined to be exempt from the regulation because they are area sources, 46 additional plants are estimated to incur costs less than 0.2 percent of their annual sales.  Only one facility in the industry is estimated to incur TAC/sales exceeding 1 percent.

The impacts of the regulation to this facility were evaluated in greater detail.  The facility for which costs

TABLE 6-1. DESCRIPTIVE STATISTICS OF FACILITY IMPACTS OF PROPOSED POLYETHER POLYOL NESHAP

| Statistic | TAC/Randomly Estimated Sales[a] | TAC/Mean Sales[b] | TAC/Median Sales[c] |
|---|---|---|---|
| Small Model Plant Category (22 facilities) | | | |
| Minimum | 0.028% | 0.028% | 0.028% |
| Maximum | 0.881% | 0.881% | 0.881% |
| Mean | 0.282% | 0.280% | 0.280% |
| Median | 0.191% | 0.192% | 0.192% |
| Catalyst Extraction Model Plant Category (15 facilities) | | | |
| Minimum | 0.168% | 0.169% | 0.168% |
| Maximum | 1.437% | 1.542% | 1.534% |
| Mean | 0.415% | 0.448% | 0.446% |
| Median | 0.335% | 0.373% | 0.371% |
| Large Model Plant Category (35 facilities) | | | |
| Minimum | 0.128% | 0.139% | 0.138% |
| Maximum | 0.214% | 0.232% | 0.229% |
| Mean | 0.144% | 0.145% | 0.143% |
| Median | 0.140% | 0.139% | 0.138% |

[a] Random sales were estimated by multiplying 1996 price by estimated production, based on randomly assigned capacity utilization rate for each model plant category.
[b] Mean sales were estimated by multiplying 1996 price by estimated production, based on mean capacity utilization rate for each model plant category.
[c] Median sales were estimated by multiplying 1996 price by estimated production, based on median capacity utilization rate for each model plant category.

exceed 1 percent of sales is estimated to produce about 23 million pounds of polyether polyols per year. Total annualized compliance costs are estimated to be $284,100 for this facility. Total annualized costs are estimated to be about 1.5 percent of annual facility sales of polyether

TABLE 6-2. FREQUENCY DISTRIBUTION: TOTAL ANNUAL COMPLIANCE COST/FACILITY SALES BY MODEL PLANT CATEGORY

| | Random[a] | Mean[b] | Median[c] |
|---|---|---|---|
| Small Model Plant | | | |
| Cost to Sales Ratios: | | | |
| 0 to 0.2 percent | 16 | 16 | 16 |
| 0.2 to 0.5 percent | 3 | 3 | 3 |
| 0.5 to 1 percent | 3 | 3 | 3 |
| 1 to 5 percent | 0 | 0 | 0 |
| Over 5 percent | 0 | 0 | 0 |
| Total | 22 | 22 | 22 |
| Catalyst Extraction Model Plant | | | |
| Cost to Sales Ratios: | | | |
| 0 to 0.2 percent | 1 | 1 | 1 |
| 0.2 to 0.5 percent | 12 | 12 | 12 |
| 0.5 to 1 percent | 1 | 1 | 1 |
| 1 to 5 percent | 1 | 1 | 1 |
| Over 5 percent | 0 | 0 | 0 |
| Total | 15 | 15 | 15 |
| Large Model Plant Category | | | |
| Cost to Sales Ratios: | | | |
| 0 to 0.2 percent | 29 | 29 | 29 |
| 0.2 to 0.5 percent | 4 | 4 | 4 |
| 0.5 to 1 percent | 2 | 2 | 2 |
| 1 to 5 percent | 0 | 0 | 0 |
| Over 5 percent | 0 | 0 | 0 |
| Total | 35 | 35 | 35 |

[a] Random sales were estimated by multiplying 1996 price by estimated production, based on randomly assigned capacity utilization rate for each model plant category.

[b] Mean sales were estimated by multiplying 1996 price by estimated production, based on mean capacity utilization rate for each model plant category.

[c] Median sales were estimated by multiplying 1996 price by estimated production, based on median capacity utilization rate for each model plant category.

polyols. This facility is owned by a large, financially strong company. Company sales were more than $2.2 billion in 1996, with net income more than $220 million. The compliance costs are an insignificant share of those resources, so it is probable that the company will choose to comply with the regulation, rather than shutting down its polyether polyol production.

## 6.2 COMPANY IMPACTS

The Agency also examines impacts of the regulation on companies owning polyether polyol facilities to determine the economic impacts of the regulation on affected companies. Of particular concern is whether small companies previously defined in Section 4.3 are adversely affected by the regulation. The measure of company impact the Agency has chosen to use is the ratio of company total annual compliance costs to company sales. For companies owning more than one affected facility, this statistic is computed by summing the annualized compliance costs across all facilities owned by the company and comparing it to total company sales. Tables 6-3 and 6-4 show frequency distributions of companywide total annual compliance costs as a share of company sales for all companies affected by the regulation and small companies, respectively.

As presented on Table 6-3, no companies affected by the regulation are expected to incur costs exceeding 1 percent of company sales. The maximum share is 0.88 percent for any of the affected companies. All but eight companies have costs less than 0.1 percent of sales.

TABLE 6-3. FREQUENCY DISTRIBUTION: COMPANY TAC AS A SHARE OF COMPANY SALES: ALL COMPANIES

| TAC/Company Sales | Frequency |
|---|---|
| 0 to 0.01 percent | 9 |
| 0.01 to 0.05 percent | 15 |
| 0.05 to 0.1 percent | 3 |
| 0.1 to 1.0 percent | 9 |
| Over 1 percent | 0 |
| Total | 36 |

To ensure that no small companies incur significant adverse impacts due to the regulation, the Agency also constructed a frequency distribution of company compliance costs to company sales for companies with fewer than 750 employees. Table 6-4 shows this distribution.

TABLE 6-4. FREQUENCY DISTRIBUTION: COMPANY TAC AS A SHARE OF COMPANY SALES: SMALL COMPANIES

| TAC/Company Sales | Frequency |
|---|---|
| 0 to 0.05 percent | 0 |
| 0.05 to 0.1 percent | 1 |
| 0.1 to 1.0 percent | 6 |
| Over 1 percent | 0 |
| Total | 7 |

No small company incurs costs exceeding 1 percent of sales. Six of the seven affected small companies incur costs between 0.1 and 1.0 percent of sales as shown in Table 6-4.

## 6.3 CONCLUSIONS

The proposed NESHAP will impose costs on producers of polyether polyols. For most facilities, the costs imposed will be negligible. Costs exceed 1 percent of sales for only one facility out of 72 affected facilities. Based on an analysis of the costs of compliance compared to facility and company financial data, the Agency finds it unlikely that the company owning this facility will choose to close it, because the company is financially robust and the costs are a small share of the company sales and net income. The generally small scale of the impacts also suggests that there will be no significant impacts on markets for the products made using polyether polyols, such as polyurethanes.

Costs do not exceed 1 percent of company sales for any of the companies owning facilities producing polyether polyols. Thus, the Agency concludes that no company is likely to go bankrupt as a result of this regulation, and no small businesses will incur significantly adverse impacts.

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

# LIST OF FIGURES

## LIST OF TABLES

LIST OF TABLES (CONTINUED)