United States
Environmental Protection
Agency

Air

# Economic Impact Analysis of the Hydrochloric Acid (HCl) Production NESHAP

# Final Report

**EPA 453/R-03-001**

**February 2003**

# Economic Impact Analysis of the Hydrochloric Acid (HCl) Production NESHAP

**Final Report**

**By:**

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**Air Quality Strategies and Standards Division**
**Integrated Strategies and Economics Group**
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## Introduction

This regulatory action issues final national emission standards for hazardous air pollutants (NESHAP) for hydrochloric acid (HCl) production facilities, including HCl production at fume silica facilities. The EPA has identified these facilities as major sources of hazardous air pollutant (HAP) emissions, primarily HCl. Hydrochloric acid is associated with a variety of adverse health effects. These adverse health effects include chronic health disorders (e.g., effects on the central nervous system, blood, and heart) and acute health disorders (e.g., irritation of eyes, throat, and mucous membranes and damage to the liver and kidneys).

These final NESHAP would implement section 112(d) of the Clean Air Act (CAA) by requiring all HCl production facilities that are major sources to meet HAP emission standards reflecting the application of the maximum achievable control technology (MACT). The EPA estimates that these NESHAP would reduce nationwide emissions of HCl by approximately 1,155 tons per year (tpy). This amount of reduction is 46 percent of the baseline HCl emissions estimate of 2,510 tpy. The EPA also estimates that these NESHAP would reduce nationwide emissions of chlorine (Cl) by approximately 430 tpy. This amount of reduction is 61 percent of the baseline HCl emissions estimate of 700 tpy.

There are 65 HCl facilities that will be subject to this final rule, according to the estimates prepared by the Agency.[1] The production processes that this NESHAP will affect are processes that routes a gaseous stream that contains HCl to an absorber, thereby creating a liquid HCl product. Among these various processes are:

- organic and inorganic chemical manufacturing processes that produce HCl as a by-product;
- the reaction of salts and sulfuric acid (Mannheim process);
- the reaction of a salt, sulfur dioxide, oxygen, and water (Hargreaves process);
- the combustion of chlorinated organic compounds;
- the direct synthesis of HCl through the burning of chlorine in the presence of hydrogen; and
- fume silica production, including combustion of silicon tetrachloride in hydrogen-oxygen furnaces.

[1] Memorandum. Maxwell, B., U.S. Environmental Protection Agency, to Hydrochloric Acid Production NESHAP Docket. Final List of Facilities Potentially Subject to the Hydrochloric Acid Production NESHAP. June 24, 2002.

It is important to note that most HCl production is as a by-product of other processes such as aliphatic and aromatic hydrocarbon chlorinations, the phosgenation of amines for isocyanates, and halogenations for making chlorofluorocarbons. Only about 5 percent of HCl is produced as primary product.

The fume silica sources affected by this final rule include any facility engaged in the production of fume silica. Fume silica is a fine white powder used as a thickener or reinforcing agent in inks, resins, rubber, paints, and cosmetics. Emissions of HCl and chlorine are the primary HAPs released from fume silica production facilities and result from the HCl recovery/production system. Because the largest HAP emission source at fume silica facilities is related to the HCl recovery/production system, we decided to combine fume silica sources and HCl production sources under this final rule.

**Background for Economic Impact Analysis**

The Agency has prepared an economic impact analysis in support of this final NESHAP. The legal authority for this analysis is Section 317 of the CAA. As part of this analysis, the Agency has prepared a small business analysis in order to comply with the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA). This economic impact analysis presents a short profile of the industries affected by this rule, a short look at the firms that will be affected by this rule, and the impacts to these firms and their consumers from implementation of the rule.

Table 1 lists the three industries that will be affected by the requirements of this final rule.

**Table 1. Affected Industries**

| Category | SIC[a] | NAICS[b] | Name of industry |
|---|---|---|---|
| Industry | 2819 | 325188 | All Other Basic Inorganic Manufacturing |
| | 2821 | 325211 | Plastic Materials, and Resin Manufacturing |
| | 2869 | 325199 | All Other Basic Organic Manufacturing |

a Standard Industrial Classification
b North American Industrial Classification System

These industries are all large with a substantial number of firms and employees that make up their operations. Table 2 contains estimates of total employees and the value of shipments for these industries as a whole.[2]

Production of HCl is but a small portion of output and activity in these industries. While the production of output reaches many millions of tons for each of these industries, the total

**Table 2**
**Value of Shipments and Employment Data on Affected Industries**
**(Millions of 1997 Dollars)**

| Industry | Value of shipments | | | Percentage change from 1997 to 1999 | Total employment (thousands) | | | Percentage change from 1997 to 1999 |
|---|---|---|---|---|---|---|---|---|
| | 1997 | 1998 | 1999 | | 1997 | 1998 | 1999 | |
| NAICS 325188 | 17,275 | 22,760 | 23,279 | 34.7 | 53.4 | 56.2 | 53.8 | 1.2 |
| NAICS 325199 | 52,405 | 48,989 | 47,151 | -10.0 | 88.2 | 86.9 | 81.2 | 7.9 |
| NAICS 325211 | 45,226 | 49,176 | 48,024 | 6.2 | 61.6 | 62.8 | 58.5 | 5.0 |

production from the U.S. HCl industry is roughly 4.2 million tons/year as of 1997. Most of the production is captive capacity; that is, the HCl is produced as an intermediate product to be used in final output. Given that about 5 percent of HCl produced in the U.S. is as primary product, this means that only about 200,000 tons of primary HCl output is generated in a typical year.

The use of HCl in the production of other chemicals is the major way in which HCl is used in the U.S. Thirty percent of HCl produced in the U.S. goes into production of other chemicals. The next most common uses of HCl are steel pickling (20 percent), oil well acidizing (19 percent), and food processing (17 percent). Other uses for HCl include semiconductor production and regeneration of ion-exchange resins for water treatment.

The U.S. imports and exports very little HCl. In 1997, the U.S. imported 85,000 tons of HCl, or only 2 percent of U.S. capacity. During that same year, the U.S. exported 60,000 tons of HCl, or only 1.5 percent of U.S. production capacity.[3] Hence, the U.S. imports as much or more HCl as

[2] U.S. Department of the Commerce: Bureau of the Census, International Trade Association. Found on the Internet at www.ita.doc.gov/td/industry/otea/usito98/tables_naics. Downloaded on September 7, 2001.

[3] U.S. Department of Commerce, Bureau of the Census. Current Industrial Reports, Series MA28A(97), September, 1998.

it exports, but the trade balance is negligible compared to the output consumed within the U.S. Most of this trade is with Canada.

The growth in U.S. HCl production averaged about 4.2 percent per year from 1993 to 1998. Growth has averaged roughly 3 percent per year from 1985 through 1998, so there has been some increase in production growth in the decade of the 1990's.[4] Prices for HCl have increased considerably from 1992 to 1998. These prices generally ranged from $40/ton to $57/ton in 1992 and 1993, but rose to over $90/ton in 1998 due to railroad disruptions that occurred late in 1997 and continued into 1998. Projected growth is expected to be about 2.5 percent per year through 2003, though this amount could be an underestimate if continued strength in oil drilling leads to additional demand for HCl.

**Costs of the Final Rule**

The estimated annual costs of the final rule are $5.9 million in 1999 dollars. These costs include not only the costs of control but also those associated with monitoring, recordkeeping, and reporting. In fact, the costs of monitoring, recordkeeping, and reporting are $4.18 million, or 71 percent of the annual costs. The capital costs are estimated at $12.36 million. The costs are estimated using ten model plants that are considered representative of the sources they are applied to. The data taken to develop the linkage between the model plants and the actual facilities are based on facility information taken from EPA permit applications and assumptions of the applicability of control equipment. Estimates of what each of these 65 plants must do to meet the final rule, which is the MACT floor, are listed in Table 4. The costs for each of the ten model plants are in Table 5. The annual costs associated with each of these model facilities includes annualized capital costs for control and monitoring equipment, annual operating and maintenance (O&M) costs for control and monitoring equipment, and labor and O&M costs associated with reporting and recordkeeping (R&R) requirements associated with the MACT floor regulatory alternative.[5]

The equipment costs include annualized capital as well as O&M and were obtained from calculations performed to estimate regulatory alternative impacts that are available in the docket. The annual R&R costs were calculated using the template used to calculate annual R&R burden in the Information Collection Request for HCl Production. The costs for the 4$^{th}$ year after promulgation, which is the first year after the compliance date for existing sources, were calculated for a single facility.

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[4]Chemical News and Intelligence, ChemExpo Chemical Profile: Hydrochloric Acid. November 22, 1999. www.chemexpo.com/news/PROFILE991122.cfm.

[5]Memorandum. Deering, A. and Norwood, P., EC/R, Incorporated, to Maxwell, B., U.S. Environmental Protection Agency. Baseline Conditions and MACT Floor Impacts for Final Hydrochloric Acid Production NESHAP. July 2, 2002.

In summary, the annual cost per facility for complying with the final MACT for HCl Production ranges from $64,348 to $169,538.

As can be seen in Table 3, sources at 41 facilities, or 63 percent of the total, will have to install a new water or caustic scrubber to meet the MACT floor requirements. As seen above, the costs for any one facility should be no higher than $169,538 (in 1999 dollars).

**Table 3. Model Facility Actions Needed To Comply With MACT Floor Alternative**

| Model facility # | Equipment needed to comply with MACT floor alternative | | | | | | # of Facilities |
|---|---|---|---|---|---|---|---|
| | Process vents (PV) | | Storage tanks (ST) | | Transfer operations (TO) | | |
| | Control equipment | Monitoring equipment? | Control equipment | Monitoring equipment? | Control equipment | Monitoring equipment? | |
| 1 | None | Yes | None | Yes | None | Yes | 8 |
| 2 | None | Yes | None | Yes | Scrubber | Yes | 5 |
| 3 | Scrubber | Yes | Scrubber | Yes | Scrubber | Yes | 3 |
| 4 | None | Yes | Scrubber | Yes | No TO | No | 7 |
| 5 | None | Yes | No ST | No | No TO | No | 13 |
| 6 | Scrubber | Yes | Scrubber | Yes | No TO | No | 8 |
| 7 | Scrubber | Yes | No ST | No | No TO | No | 5 |
| 8 | No PV | No | Scrubber | Yes | No TO | No | 6 |
| 9 | No PV | No | None | Yes | No TO | No | 3 |
| 10 | No PV | No | Scrubber | Yes | No TO | No | 7 |

**Table 4. Annual Costs For Each Model Facility**

| Model facility # | Annual costs per facility (1999$) | | | | |
|---|---|---|---|---|---|
| | PV Equipment | ST Equipment | TO Equipment | R&R Labor and O&M | Total |
| 1 | $1,212 | $1,212 | $1,212 | $64,348 | $67,984 |
| 2 | $1,212 | $1,212 | $6,383 | $64,348 | $73,155 |
| 3 | $92,424 | $6,383 | $6,383 | $64,348 | $169,538 |
| 4 | $1,212 | $6,383 | $0 | $64,348 | $71,943 |
| 5 | $1,212 | $0 | $0 | $64,348 | $65,560 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | $92,424 | $6,383 | $0 | $64,348 | $163,155 |
| 7 | $92,424 | $0 | $0 | $64,348 | $156,772 |
| 8 | $0 | $6,383 | $0 | $64,348 | $70,731 |
| 9 | $0 | $1,212 | $0 | $64,348 | $65,560 |
| 10 | $0 | $0 | $0 | $64,348 | $64,348 |

The annual costs shown in Table 4 can be considered reasonable representations of potential facility-level cost impacts associated with the MACT floor level of control. Appendix A provides more specific information on the representation of facilities in the HCl cost analysis.

**Cost and Economic Impact Results**

Table 5 lists the compliance (control, monitoring, and R&R) costs of the MACT floor regulatory alternative per affected parent company, and these costs as a percentage of the parent companies's revenues. All data below are based on 1999 statistics, unless more recent data are available.

The economic impact analysis, which is essentially a comparison of compliance costs for the affected parent firms with their revenues, shows that the estimated costs associated with the MACT floor option are no more than 1.0 percent of the revenues for any of the 33 affected firms. It is important to note that most of the companies and facilities affected by this standard are large U.S. companies or subsidiaries of large multinational companies. It is likely that the expected reduction in affected HCl and fume silica output is no more than 0.0015 percent or less from that industry, since the overall compliance costs are less than 0.001 percent of the revenues for the affected parent firms, and a price elasticity of demand of -1.5 that is applicable to NAICS 325199 and 325211 as prepared for another economic analysis done for a recently proposed

**Table 5.**
**Economic Impacts for Parent Companies Affected by the Final HCl/Fume Silica MACT***

| Parent company | Number of employees | Large or small business? | Revenues (million 1999$ unless stated differently) | Annual compliance costs (1999$) | Compliance costs/revenues (%) |
|---|---|---|---|---|---|
| Arch Chemicals | 3,500 | Large | 900 | 67,984 | 0.0008 |
| Ausimont USA (subsidiary of Montedison Group) | 33,049 | Large | 11,266 (2000) | 163,155 | 0.00145 |
| Aventis CropScience | 92,500 | Large | 20,021 | 70,731 | 0.0004 |

| | | | | | |
|---|---|---|---|---|---|
| BASF Corp. | 100,000 | Large | 32,226 (2000) | 67,984 | 0.00021 |
| CIBA-GEIGY Corp. (subsidiary of Novartis) | 69,000 | Large | 17,200 | 156,772 | 0.0009 |
| Crompton Corp. | 8,300 | Large | 3,038 | 65,560 | 0.0020 |
| Detrex Corp. | 353 | Small | 96 | 71,943 | 0.08 |
| Dover Chemical Corp. (subsidiary of ICC Industries Corp.) | 3,200 | Large | 1,500 | 64,348 | 0.0043 |
| Dow Chemical | 41,943 | Large | 23,008 | 65,560 | 0.00029 |
| DuPont | 93,000 | Large | 28,268 | 169,538 | 0.0006 |
| Elf Atochem (subsidiary of TotalFinaElf) | 127,252 | Large | 67,352 | 163,155 | 0.00024 |
| Ferro Corp. | 6,700 | Large | 1,360 | 70,731 | 0.0052 |
| FMC Corp. | 15,000 | Large | 3,900 | 67,984 | 0.0017 |
| General Electric Co. | 313,000 | Large | 129,500 | 318,927 | 0.00025 |
| Honeywell Corp. | 125,000 | Large | 23,735 | 163,155 | 0.0007 |
| Huntsman Corp. | 14,000 | Large | 7,000 | 65,560 | 0.00094 |
| ICI Americas (part of ICI Corp.) | 45,130 | Large | 8,592 | 73,155 | 0.0085 |
| Jones-Hamilton Co. | 81 | Small | 27 | 67,984 | 0.25 |
| Louisiana Pigment Co. (owned by NL Industries) | 2,500 | Large | 908 | 70,731 | 0.008 |
| MDA Manufacturing (owned by Daitkin Products, Inc.) | 14,000 | Large | 3,799 | 163,155 | 0.00452 |
| Metachem Products | 110 | Small | 30 | 156,772 | 0.523 |
| Miles Bayer (owned by the Bayer Group) | 120,400 | Large | 27,320 | 65,560 | 0.00024 |
| Monsanto Co. | 14,700 | Large | 5,500 | 67,984 | 0.00124 |
| Occidental Chemical Co. (owned by Occidental Petroleum Co.) | 8,800 | Large | 13,574 | 73,155 | 0.00054 |
| Oxymar (owned by Occidental Petroleum Co. and Marubeni Co.) | 13,851 | Large | 73,000 | 156,772 | 0.00021 |

| | | | | | |
|---|---|---|---|---|---|
| Oxyvinyls | (a joint venture of Occidental Petroleum Co. and Polyone International) - 18,800 | Large | 17,074,000 (combined revenue of Occidental Petroleum and Polyone International) | 163,155 | 0.0010 |
| PPG Industries | 33,000 | Large | 8,370 | 169,538 | 0.002 |
| Shell | 95,000 | Large | 149,146 | 156,772 | 0.00011 |
| Velsicol Chemical Corp. | 600 | Small | 200 | 73,155 | 0.037 |
| Vulcan Materials | 9,315 | Large | 2,492 | 70,731 | 0.0028 |
| Chao Group (of Thailand, owner of Westlake Monomers) | 25,000 | Large | 3,000 | 163,155 | 0.00544 |
| Fume Silica | | | | | |
| GE Silicones (owned by GE) | 313,000 | Large | 128,543 | 65,560 | 0.00005 |
| Cabot | 4,200 | Large | 1,517 | 65,560 | 0.0043 |
| Degussa | 63,000 | Large | 12,567 | 169,538 | 0.00135 |

* Employee and revenue data taken from the large companies's Web sites, www.business.com, or Hoover's Online, or from Ward's Business Directory for the small companies.

MACT standard affecting these NAICS codes.[6] The price elasticity of demand is defined as the percent change in consumer demand that occurs as a result of a percent change in product price. Given the very small increase in cost to affected producers, and their fairly small ability to pass through these costs to their consumers (any price elasticity of demand less than -1 is considered "highly elastic"). In addition, it is likely that the impacts to individual firms should not be substantial, since the cost to sales estimates per firm are much less than the average profit margin (i.e., profit per unit of sales by firm) enjoyed by firms in these industries (about 5 percent).[7] It should be noted that these results are based on the application of costs from a subset of the affected facilities to the remaining facilities. This is necessary due to incomplete facility-level cost data, as explained in the previous section on costs.

[6] U.S. Environmental Protection Agency. Economic Impact Analysis of Air Pollution Regulations: Organic Liquid Distribution. Produced by the Research Triangle Institute. February 2002.

[7] Reference 6.

**Small Business Impacts**

The RFA generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as a small business according to Small Business Administration size standards[8] by the North American Industry Classification System (NAICS) category of the owning parent entity. The small business size standard for the affected industries (NAICS 325188, All Other Basic Inorganic Chemical Manufacturing, NAICS 325199, All Other Basic Organic Manufacturing, and NAICS 325211, Plastics Materials, and Resins Manufacturing) is a maximum of 1,000 employees for an entity.

After considering the economic impact of today's final rule on small entities, I certify that this action will not have a significant impact on a substantial number of small entities. In accordance with the RFA, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), 5 U.S.C. 601, et. seq., EPA conducted an assessment of the final standard on small businesses within the industries affected by the rule. Based on SBA size definitions for the affected industries and reported sales and employment data, the Agency identified four affected small businesses out of 33 affected parent businesses (or 12 percent of the total number). In order to estimate impacts to affected small businesses, the Agency conducted a screening analysis that consists of estimates of the annual compliance costs these businesses are expected to incur as compared to their revenues. Since the data are such that costs can only be estimated for a subset of the affected facilities, the available data were used to determine the costs to the facilities outside of this subset. The results of this screening analysis show that none of the small businesses is expected to have annual compliance costs of 1 percent or more. Therefore, this analysis allows us to certify that there will not be a significant impact on a substantial number of small entities from the implementation of this final rule.

A summary of the small business impacts, with a comparison to the impacts to the large companies, is in Table 6. The median compliance cost as a percent of sales for the affected small companies affected is 0.39 percent, which is larger than that for the affected large companies (0.001 percent).

[8] Small Business Administration, Washington, D.C. Found on the Internet at www.sba.gov/size.

**Table 6**
**Summary of Small Business Impacts for HCl Production and Fume Silica**
**MACT Floor Option**

| | |
|---|---|
| **Total number of companies** | 33 |
| **Total number of small companies** | 4 |
| **Total number of large companies** | 29 |
| **Average annual compliance cost per small company (in 1999 dollars)** | $92,463 |
| **Average annual compliance cost per large company (in 1999 dollars)** | $118,471 |
| | |
| **Comparison of compliance costs to sales** | |
| **Compliance costs of <1% of sales** | Small: 4 Share: 100%<br>Large: 29 Share: 100% |
| **Compliance costs of >1% of sales** | Small: 0 Share: 0%<br>Large: 0 Share: 0% |
| | |
| **Compliance cost to sales: Statistics (%)** | Average: 0.0288<br>For Small: 0.220<br>For Large: 0.0021 |
| | Median: 0.00145<br>For Small:0.165<br>For Large: 0.001 |
| | Maximum: 0.523<br>For Small: 0.523<br>For Large: 0.0085 |
| | Minimum: 0.0001<br>For Small: 0.037<br>For Large: 0.00005 |

# Appendix A

# Summary of Representation of Actual Facilities in HCl Production NESHAP Cost Analysis

## Summary of Representation of Actual Facilities in the HCl Production Impacts Analysis

| | Number of facilities in MACT Floor Data Set | Assumed controls needed | Plant Names |
|---|---|---|---|
| No process vents | 4 | | DuPont, KY; LaRoche, LA; PPG, WV; Vista, LA |
| Process vents | 12 | | |
| 99+% | 9 | None | Allied Signal, LA; Bayer, WV; Degussa, NY; Dow, LA;[a] DuPont, LA; DuPont, WV; Formosa, TX; Georgia Gulf, LA; Louisiana Pigment |
| 95% | 3 | New scrubber | Dow, LA;[a] DuPont Dow, LA; Shell, LA |
| No storage tanks | 6 | | Bayer, WV; Degussa, NY; DuPont, LA; Formosa, TX; Georgia Gulf, LA; Shell, LA; |
| Storage tanks | 10 | | |
| 99+% | 4 | None | Dow, LA;[a] DuPont, KY; PPG, WV; DuPont, WV |
| 95% | 3 | New scrubber | Allied Signal, LA; DuPont Dow, LA; Vista, LA |
| 0% | 3 | New scrubber | Louisiana Pigment; Dow, LA[a]; LaRoche, LA |
| No transfer operations | 12 | | Allied Signal, LA; Bayer, WV; Degussa, NY; Dow, LA;[a] DuPont, LA; DuPont Dow, LA; DuPont, WV; Georgia Gulf, LA; LaRoche, LA; Louisiana Pigment; PPG, WV; Vista, LA |
| Transfer operations | 4 | | |
| 99+% | 2 | None | DuPont, KY; Formosa, TX |
| 95% | 1 | Scrubber | Dow, LA[a] |
| 0% | 1 | Scrubber | Shell, LA |

[a] There are two facilities at this plant site. For process vents and storage tanks, the two facilities control at different levels. Only one of the two facilities has a transfer operation.

## TECHNICAL REPORT DATA

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

**This document is an economic impact analysis for the industries and other entities subject to the Hydrochloric Acid Production National Emission Standards for Hazardous Air Pollutants (NESHAP). The analysis shows price and production changes for affected entities as a result of incurring the costs of this rule, and provides some financial data for those entities and the industries they are in.**

`17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Control Costs<br>Industry Profile<br>Economic Impacts | Air Pollution control | |

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