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National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Category: Metal Furniture Surface Coating -- Background Information for Proposed Standards

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Emission Standards Division

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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ENVIRONMENTAL PROTECTION AGENCY

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) FOR SOURCE CATEGORY: METAL FURNITURE SURFACE COATING - BACKGROUND INFORMATION FOR PROPOSED STANDARDS

1. The standards regulate organic hazardous air pollutant (HAP) emissions from the surface coating of metal furniture. Only those metal furniture surface coating operations that are part of major sources under section 112(d) of the Clean Air Act (CAA) will be regulated.

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METAL FURNITURE SURFACE COATING NESHAP
BACKGROUND INFORMATION DOCUMENT

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1.0 SUMMARY

1.1 INTRODUCTION

This background information document (BID) supports proposal of the national emission standards for hazardous air pollutants (NESHAP) for limiting emissions of organic hazardous air pollutant (HAP) emissions from the metal furniture surface coating source category. The standards are being developed under the authority of section 112(d) of the Clean Air Act as amended in 1990 (CAA).[1]

This document is divided into nine chapters providing a combination of background information and EPA rationale for decisions made in the standards development process. Chapter 2 presents an overview of the NESHAP regulatory process and briefly describes the history of this project. Chapters 3 through 5 provide background information including: an industry description in Chapter 3, the emission control techniques available to this industry in Chapter 4, and nationwide baseline characteristics and model plants representing the metal furniture surface coating industry in Chapter 5. Chapter 6 describes how we determined the maximum achievable control technology (MACT) "floors", and an evaluation of the control alternatives beyond the floor. Chapters 7 and 8 present the predicted HAP emission reduction and cost impacts associated with the proposed standards, respectively. Chapter 9 presents the results of the economic analysis for the proposed standards. Relevant background material has been repeated in several of these chapters. While this leads to a certain amount of repetitiveness in this document, the intent was to allow the reader to focus on a specific topic without necessarily having to read one or more previous chapters to understand the context in which the relevant material was developed. The repetitive material has been kept to a minimum, and references to the chapters that contain more detailed information have been provided throughout the text for the reader who requires a more in-depth understanding of the background material.

The appendices to this document provide additional background information. Supporting information and more detailed descriptions for the technical and rationale chapters of this document are provided in the items referenced in each chapter and located in the project docket.

The term "coating application" as used in this BID refers to the application of protective coatings, adhesives, and other types of coatings. Protective coatings mean either protective or decorative coatings, and generally refer to the paint applied to the metal furniture parts, components, or completed assemblies. In this BID, the term "coatings" refers to all coatings and adhesives used in the metal furniture manufacturing process, unless otherwise limited.

1.2 PROPOSED STANDARDS FOR AFFECTED SOURCES

The proposed standard for new sources is an affected-source-wide organic HAP emission limit of 0.094 kg organic HAP/liter coating solids (nonvolatiles) used (0.78 lb/gal). For existing sources, the emission limit is 0.12 kg organic HAP/liter coating solids used (1.0 lb/gal). The term "coating solids used" refers to the volume of coating solids, or nonvolatiles, contained in the total amount of coatings (including adhesives) used. It is not related to the transfer efficiency or the amount of coating solids actually applied (deposited) on the surfaces being coated. These limits take into account emissions from all unit operations that may emit organic HAP from the metal furniture manufacturing operations associated with surface coating (i.e., the affected source). This collection of operations includes all of the following:

- Surface preparation of the metal furniture prior to coating application
- Preparation of a coating for application (e.g., mixing in additives, dissolving resins)
- Application of a coating to metal furniture
- Flashoff, drying, and curing following coating application
- Cleaning of equipment used in the coating application operation
- Storage of coatings, additives, and cleaning materials
- Conveyance of coatings, additives, and cleaning materials from storage areas to mixing areas or

to coating application areas, either manually or by automated means

- Handling and conveyance of waste materials generated by the surface coating operation.

This approach is consistent with the general industry trend of lowering emissions by reducing the mass of pollutants in coatings and cleaning materials rather than by the use of add-on control devices. The performance-based nature of these emission limits allows the metal furniture surface coating industry flexibility in choosing between many available control methods (including but not limited to coating reformulation, conversion to powder coating, solvent elimination, work practices, and add-on control devices) to achieve compliance.

1.3 ENVIRONMENTAL IMPACTS

As stated above, there are a variety of compliance methods available to and in use by the industry to meet the MACT floor level of control for organic HAP emissions. Various combinations of the available control methods may be utilized to achieve the MACT floor level of control. Environmental impacts for new and existing sources were estimated assuming that all sources will convert from existing liquid coatings and organic HAP cleaning materials to lower organic HAP content liquid coatings and organic HAP-free cleaning materials such that the organic HAP emission rate for the affected source is equal to the proposed emission limit for existing and new sources. Detailed analyses of the environmental impacts are discussed in Chapter 7 of this document. The nationwide organic HAP emissions for existing sources in the fifth year after promulgation of standards implementing the MACT floor level of control were estimated to be 6,400 Mg/yr. This represents an organic HAP emission reduction of 13,900 Mg/yr (15,300 tons/yr) from existing sources. The estimated organic HAP emission reduction for the 20 new sources anticipated to be in operation in the fifth year after promulgation of standards implementing the MACT floor level of control was estimated to be 465 Mg/yr (511 tons/yr).

1.4 COST IMPACTS

Cost estimates for implementing control methods to comply with the proposed emission limits were based on applying the same compliance methodology presented above for the environmental impacts. Estimates of nationwide capital and annual costs are detailed in Chapter 8. Capital costs result from purchasing equipment necessary to implement the specific control methods of each option. For new and existing sources, no capital costs would be incurred because the conversion from higher organic HAP content coatings and cleaning materials to lower organic HAP content coatings and organic HAP-free cleaning materials would not require the purchase of new equipment. Annual cost impacts for new and existing sources reflect the increased cost for coatings, cleaning materials, and the cost of implementing monitoring, reporting, and recordkeeping (MR&R) requirements. Nationwide annual costs for existing sources, including MR&R costs, were estimated to be $14.8 million in the fifth year after promulgation of the standards. Nationwide annual costs for new sources, including MR&R costs, were estimated to be $0.6 million in the fifth year after promulgation of the standards.

1.5 REFERENCES

1. United States Congress. Clean Air Act as amended 1990. 42 U.S.C. 7401, et seq. Washington, D.C. Government Printing Office. November 1990.

2.0 INTRODUCTION

2.1 OVERVIEW

The Clean Air Act as amended in 1990 (CAA) requires that the emission standards for new sources be no less stringent than the emission control achieved in practice by the best controlled similar source. For existing sources, the emission control can be less stringent than the emission control for new sources, but it must be no less stringent than the average emission limitation achieved by the best performing 12 percent of existing sources (for which the EPA has emissions information). In categories or subcategories with fewer than 30 sources, emission control for existing sources must be no less stringent than the average emission limitation achieved by the best performing 5 sources. The NESHAP are commonly known as maximum achievable control technology (MACT) standards.

The purpose of this document is to summarize the background information gathered during the development of the metal furniture surface coating industry NESHAP.

2.2 PROJECT HISTORY

2.2.1 Regulatory Background

Federal regulations that apply to metal furniture surface coating include a New Source Performance Standard (NSPS) under 40 CFR Part 60, Subpart EE, "Standards of Performance for Surface Coating of Metal Furniture," which is applicable to each metal furniture surface coating operation in which organic coatings are applied. For the purposes of subpart EE, a surface coating operation may be a prime coat or topcoat operations, and includes the coating application station, flashoff area, and curing oven. The metal furniture surface coating NSPS regulates emissions of volatile organic compounds (VOC) and limits these emissions to 0.90 kilogram of VOC per liter of coating solids (nonvolatiles) applied. The NSPS was proposed on November 28, 1980, and promulgated on October 29, 1982. All metal furniture surface coating operations that were modified or began construction or reconstruction after November 28, 1980, must be in compliance with the NSPS.

In addition to the NSPS, the EPA also published a Control Techniques Guideline (CTG) document[1] that covers metal furniture surface coating operations. The CTG was intended as guidance for States in the development of State Implementation Plans (SIP). The CTG defined reasonably available control technology (RACT) for metal furniture surface coating operations as 0.36 kilograms of organic solvent emitted per liter of coating (minus water and 'exempt' solvents). This limit is based on the use of low organic solvent coatings or waterbased coatings, and is approximately equivalent (on the basis of coating solids applied) to the use of an add-on control device that collects or destroys about 80 percent of the solvent from a high organic solvent coating.[2]

Most States that have emission limitations specific to metal furniture surface coating follow the CTG guidance. As of 1997, thirty states have limits substantially the same as the CTG, some with different limits for individual coating types or curing methods (e.g., specialty coatings, air-dried coatings, baked coatings). Three States have limits less stringent than the CTG, and one State is more stringent. One State has an emission limit in units not directly convertible to those of the CTG. The remaining 15 States have no VOC limits specific to metal furniture surface coating operations.[3]

None of the Federal or State regulatory efforts is specifically directed toward HAP; however, most HAP of concern in the metal furniture surface coating industry are VOC and the same methods used to limit VOC emissions are also applicable to HAP emissions. The primary use of HAP is as a solvent in the coatings applied to metal furniture. The specific HAP used in the metal furniture surface coating industry and the sources of HAP emissions are described in Chapter 3 of this document.

The MACT standard development for the metal furniture surface coating industry began in April 1997 with a Coating Regulations Workshop for representatives of the EPA and interested stakeholders and continues as a coordinated effort to promote consistency and joint resolution of issues common across nine surface coating source categories. The workshop covered eight categories: fabric printing, coating, and dyeing; large appliances; metal can; metal coil; metal furniture; miscellaneous metal parts; plastic parts; and wood building products. The automobile and light duty truck project was started subsequently.

The first phase was one in which the EPA gathered readily available information about the industry with the help of representatives from the regulated industry, State and local air pollution control agencies, small business assistance providers, and environmental groups. The goals of the first phase were to either fully or partially:

- Understand the coating process
- Identify typical emission points and the relative emissions from each industry
- Identify the range(s) of emission reduction techniques and their effectiveness
- Make an initial determination on the scope of each source category
- Determine the relationship and overlaps of the source categories
- Locate as many facilities as possible, particularly major sources
- Identify and involve representatives for each industry segment
- Complete informational site visits
- Identify issues and data needs and develop a plan for addressing them
- Develop questionnaire(s) for additional data gathering and
- Document results of the first phase of regulatory development for each category.

The industry members that participated in the stakeholder process included members of the American Furniture Manufacturers Association, Business and Institutional Furniture Manufacturer's Association, National Paint and Coatings Association, representatives of individual companies in the regulated industry, and representatives of companies that supply coatings to the industry. States that participated in the process included Florida, Illinois, and Pennsylvania. In addition, data were obtained from several other states including Alabama, California, Georgia, Indiana, Kansas, and Tennessee. The U.S. EPA was represented by EPA Region 5, the EPA Office of Air Quality Planning and Standards (OAQPS), the EPA Office of Enforcement and Compliance Assurance (OECA), the EPA Office of Pollution Prevention and Toxic Substances (OPPTS), and an EPA Small Business Ombudsman. A list of participants in the surface coating of metal furniture rule development effort is presented in Appendix B of this document.

The first phase of the MACT standard development concluded with the drafting of a preliminary industry characterization (PIC) document for the metal furniture surface coating industry.[4] The information summarized in the PIC document can be used by States that may have to make case-by-case MACT determinations under Section 112(g) or 112(j) of the CAA. The initial phase of the regulatory development focused primarily on familiarizing the project team with metal furniture surface coating operations, identifying facilities that make up the industry, and investigating the emission control technologies in use by facilities in the industry.

2.2.2 Data Gathering

Information presented in this document was collected from a variety of sources. Data collection began with a review of information collected by the EPA during development of the NSPS. A total of five stakeholder meetings were held for the purpose of information exchange and the identification of potential data sources. (The participants are listed in Appendix B of this document.) Information was also collected during site visits to nine metal furniture surface coating facilities that operate metal furniture coating operations with a wide variety of production rates, coating types, and product types. On August 20, 1997, a telephone conference meeting was held with the regulatory subgroup, which is made up of EPA and State representatives.[5]

In June 1997 and June 1998 industry questionnaires were developed for gathering information for the development of the metal furniture surface coating industry MACT standard. The questionnaires were sent to 39 companies with metal furniture surface coating operations identified through literature sources and stakeholder contacts. Responses were received from a total of 85 individual facilities. Of these 85 facilities, 59 were determined to be metal furniture surface coating facilities, 49 of which were major or synthetic minor sources of HAP. The coating information obtained from the questionnaire responses included approximately 680 coatings representing over 9 million liters of usage.

2.3 REFERENCES

1. Control of Volatile Organic Emissions from Existing Stationary Sources Volume III: Surface Coating of Metal Furniture. EPA-450/2-77-032. U.S. Environmental Protection Agency, Office of Air and Waste Management, Research Triangle Park, North Carolina. December 1977.

2. Note 1. p. iv.

3. Enflex Database of Federal and State Statutes. West Group, Eagan, MN. 1997.

4. Preliminary Industry Characterization: Surface Coating of Metal Furniture. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September 1998.

5. Memorandum submitted by Dr. Mohamed Serageldin, EPA:ESD, to the Metal Furniture Project Docket No. A-97-40. Integrated Rule Development (P-MACT/P-BAC Phase), Regulatory Subgroup Teleconference. August 20, 1997.

3.0 INDUSTRY CHARACTERIZATION

3.1 INTRODUCTION

This chapter provides a general description of the metal furniture industry, the source category, and the production process. Discussions of emission sources from each unit operation, the number of potentially affected sources, and national baseline emissions are also included.

As discussed more fully in Chapter 5, it was estimated that there are 3,002 facilities that produce metal furniture parts or products. These facilities are located throughout the U.S., with the highest concentration of facilities in California, Michigan, New York, Florida, and Illinois.[1] Of these facilities, it was estimated that 655 are major sources of hazardous air pollutants (HAP). The remaining 2,347 facilities are minor (area) sources of HAP emissions, with 1,435 of these area sources located in urban areas. Baseline (before additional control) organic HAP emissions were estimated to be 20,300 Mg/yr (22,300 tons/yr) from the major sources.

3.2 SOURCE CATEGORY DESCRIPTION

For the purpose of developing national emission standards for hazardous air pollutants (NESHAP), the EPA initially defined the metal furniture surface coating source category as "any facility engaged in the surface coating and manufacture of metal furniture parts or products.'[2] This description was meant to identify what may be included in the metal furniture source category and did not represent a complete delineation of all possible emission sources within the source category. Therefore, using definitions from the new source performance standard[3] and control techniques guidelines[4], as well as various state regulations, the source category definition has been clarified as encompassing facilities that apply coatings in the manufacture of metal furniture or component parts of metal furniture. Metal furniture means furniture or components of furniture constructed either entirely or partially from metal. Metal furniture includes, but is not limited to, components of the following types of products as well as the products themselves: household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture. Metal furniture also includes office and store fixtures, partitions, shelving, lockers, lamps and lighting fixtures, and wastebaskets.

The corresponding Standard Industrial Classification (SIC) codes and North American Industry Classification System (NAICS) codes for these products may be divided into two groups. The first group are those codes that deal almost exclusively with metal furniture products and are shown in Appendix C, Table C-1. The second group, shown in Table C-2, are those codes related to metal furniture but that only partially encompass metal furniture products. Table C-3 lists all of these SIC codes and their corresponding NAICS codes.

3.3 PROCESS DESCRIPTION AND EMISSION POINTS

The metal furniture industry typically utilizes liquid coatings with a wide range of coating solids content, as well as powder coatings. Typical organic HAP reported in liquid coatings include, but are not limited to, methyl ethyl ketone, toluene, xylene, and methyl isobutyl ketone.

A simplified process flow diagram of the metal furniture manufacturing process is provided in Figure 3-1 in which the different unit operations are shown. The metal furniture manufacturing process may be divided into five main unit operations: (1) raw material preparation, (2) cleaning operations, (3) coating application systems, (4) adhesive application operations, and (5) assembly. Each of these unit operations is described briefly in the following sections.

3.3.1 Raw Material Preparation

Raw materials generally consists of steel rods, tubes, or coiled steel sheets. The material is cut to size and processed through various stamping, forming, bending, and welding steps. At this point in the process, the metal furniture unit may be completely assembled, as in the case of

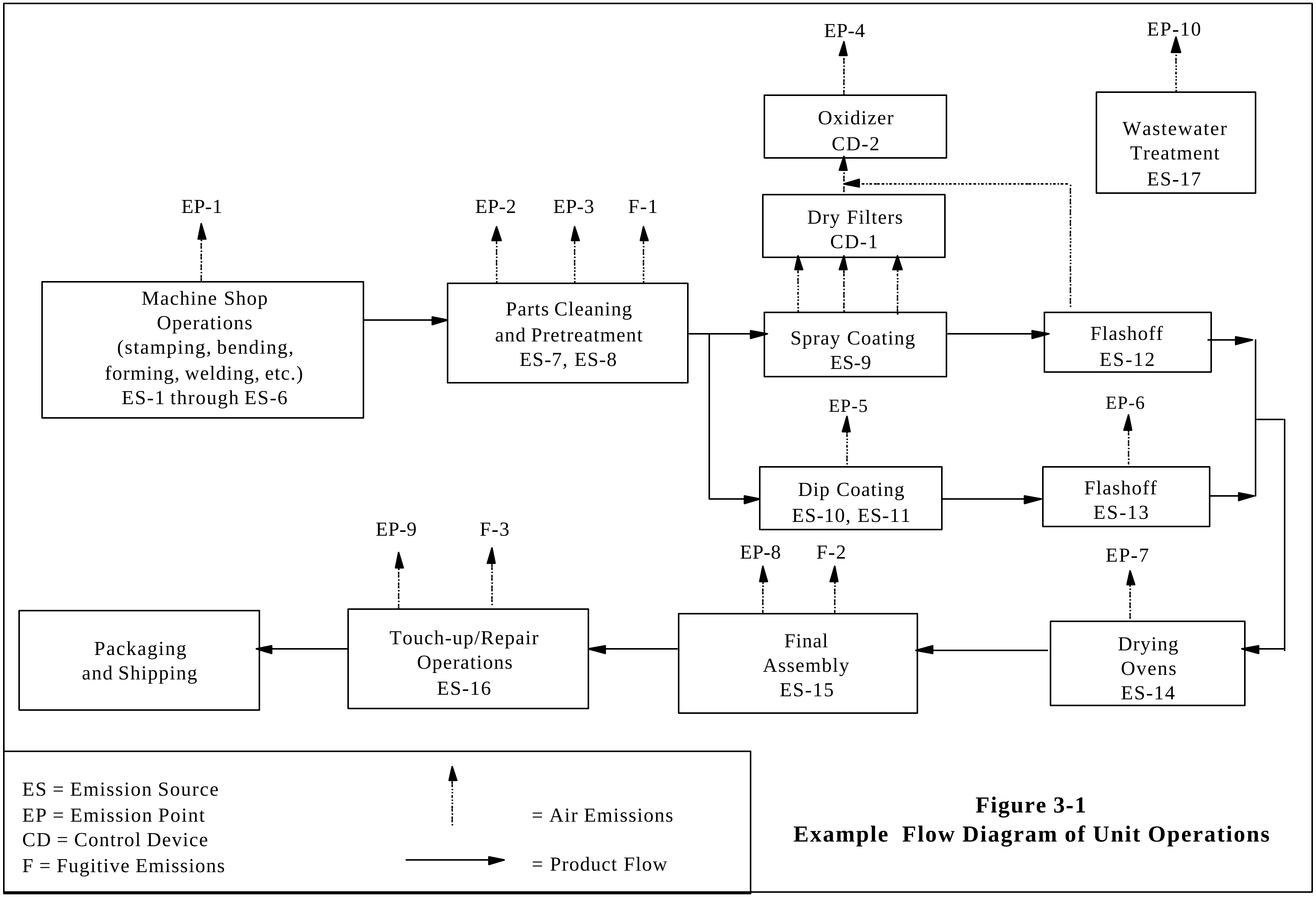


Figure 3-1
Example Flow Diagram of Unit Operations

an outdoor patio chair, and ready for surface finishing. However, other items, particularly office furniture such as filing cabinets, will require assembly after surface coating.

3.3.2 Cleaning Operations

Before a metal furniture part or component can be coated, its surface must be thoroughly cleaned. The cleaning unit operation system (UOS)5 shown in Figure 3-2 provides a representation of a typical metal furniture cleaning operation and the steps where air emissions may occur. This operation consists of the following basic processing stages: 1) alkaline or acid cleaning, 2) water rinse, 3) phosphate treatment (typically iron phosphate), 4) water rinse, and 5) pretreatment and/or water rinse. The last stage in that operation involves drying the parts in an oven.

In the alkaline or acid cleaning stage, metal parts are sprayed with, or immersed in, a cleaning bath to dissolve and remove oil, grease, and dirt. This bath, which can be alkaline or acidic, typically includes one or more other ingredients such as surfactants or corrosion inhibitors. Generally, acid-based solutions are preferred for removing corrosion and scale from metal pieces. However, because alkaline formulations are generally somewhat milder, they are recommended for certain metal substrates when the corrosivity of acid solutions is a concern.

The cleaning stage is followed by a phosphate treatment stage. The purpose of this treatment is to provide corrosion resistance to the surface of the metal part. The final pretreatment stage, if utilized, may be a rust inhibitor or adhesion promoter.

Following each treatment stage, the substrate is typically sent through several rinse stages in series, which are schematically represented by one rectangle in Figure 3.2. A counterflow rinsing system is commonly utilized. A counterflow rinsing system is a sequence of rinse steps in which replenished rinse water moves in the opposite direction of the substrate flow. The parts being cleaned progress from dirtier to cleaner rinse water. The system maximizes water use by adding fresh water only at the final rinse stage in the sequence. Thus, the part is exposed to the cleanest rinse water just before proceeding to the next treatment stage.

In general, the chemicals used contain little organic HAP or volatile organic compound (VOC) materials and, therefore, this type of cleaning operation generates negligible emissions.

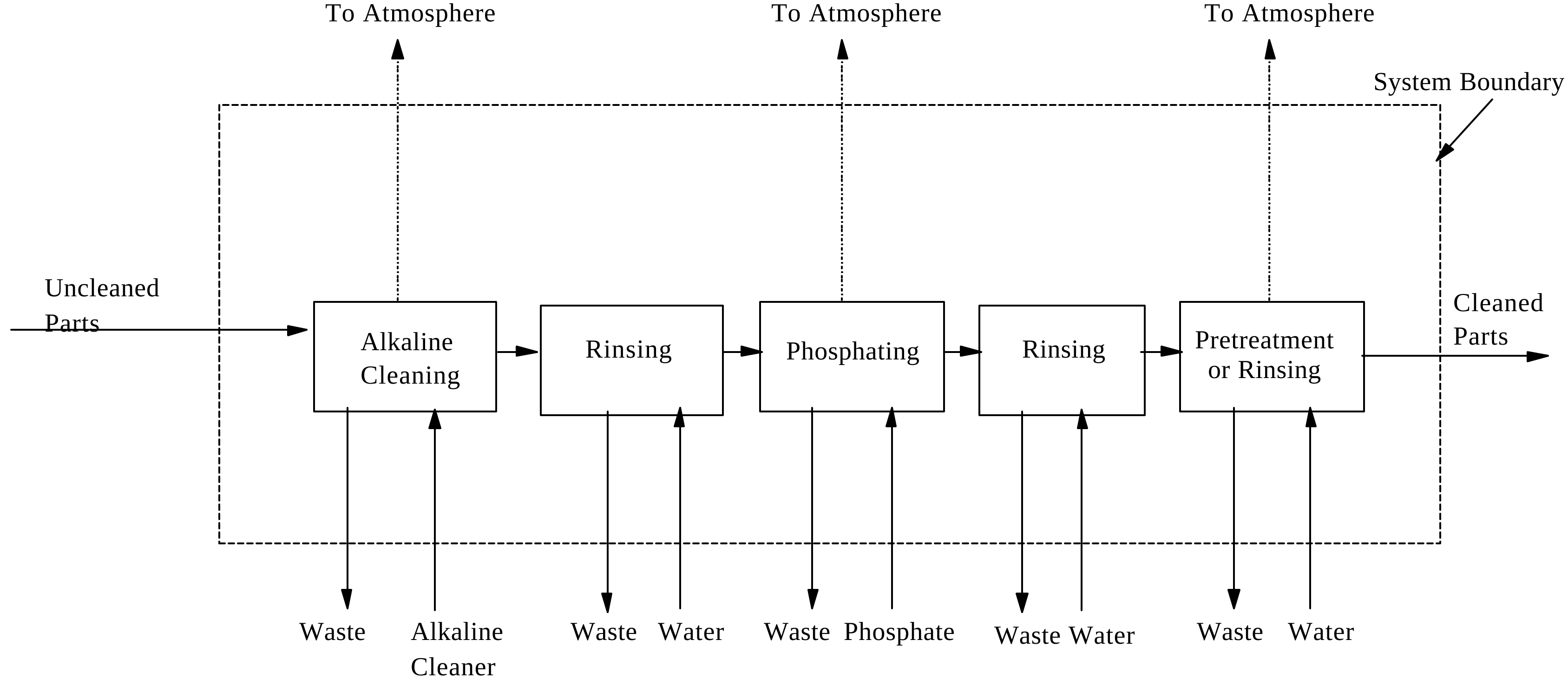
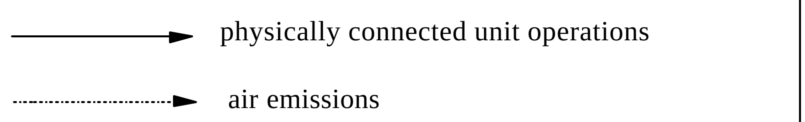


Figure 3-2. UOS for Cleaning Operation System Prior to Coating



An alternate cleaning method uses an enclosed shot-blasting operation as the means of cleaning prior to coating. The operation uses steel shot (fine particles) to abrasively remove dirt and grease, as well as to smooth rough edges and welds. The operation can also be used to remove cured coatings when parts require rework. Although the steel shot is recycled back to the enclosure containing the parts, a small amount of particulate matter emissions is generated by this operation. However, the cleaning operation does not involve any liquid chemicals, and no wastewater discharge is produced.[6]

While the two cleaning operations discussed above result in minimal organic HAP and VOC emissions, more significant emissions may occur from other cleaning operations including spray gun cleaning, paint line flushing, rework operations, and touchup cleaning at final assembly.

3.3.3 Coating Application Systems

Surface coating is accomplished by means of applying a coating to the metal part, then curing or drying the coating. The coating itself may be in the form of a liquid or powder, and may be applied by means of spray or dip application operations. Nearly all sprayable coatings are electrostatically applied, as well as many dip coatings. The presence of the electrostatic field creates an electrical attraction between the paint, which is positively charged, and the grounded metal part and enhances the amount of coating deposited on the part. The distribution of coating line types as reported in the 1997 and 1998 industry questionnaire responses is shown in Figure 3-3.

Sprayable liquid coatings are applied in a booth by manual or automatic means. In some instances, productivity is maximized by using automatic application followed by manual touchup. Typically, overspray is collected on dry filters within the booth. Waterwash booths are less commonly used in the metal furniture industry. Alternatively, the overspray can be collected on a series of baffles installed prior to the dry filters or waterwash and collected for reuse. Both air emissions and waste (including spent dry filters) generated by the coating application operation are substantially reduced through the use of this recycling method.[7]

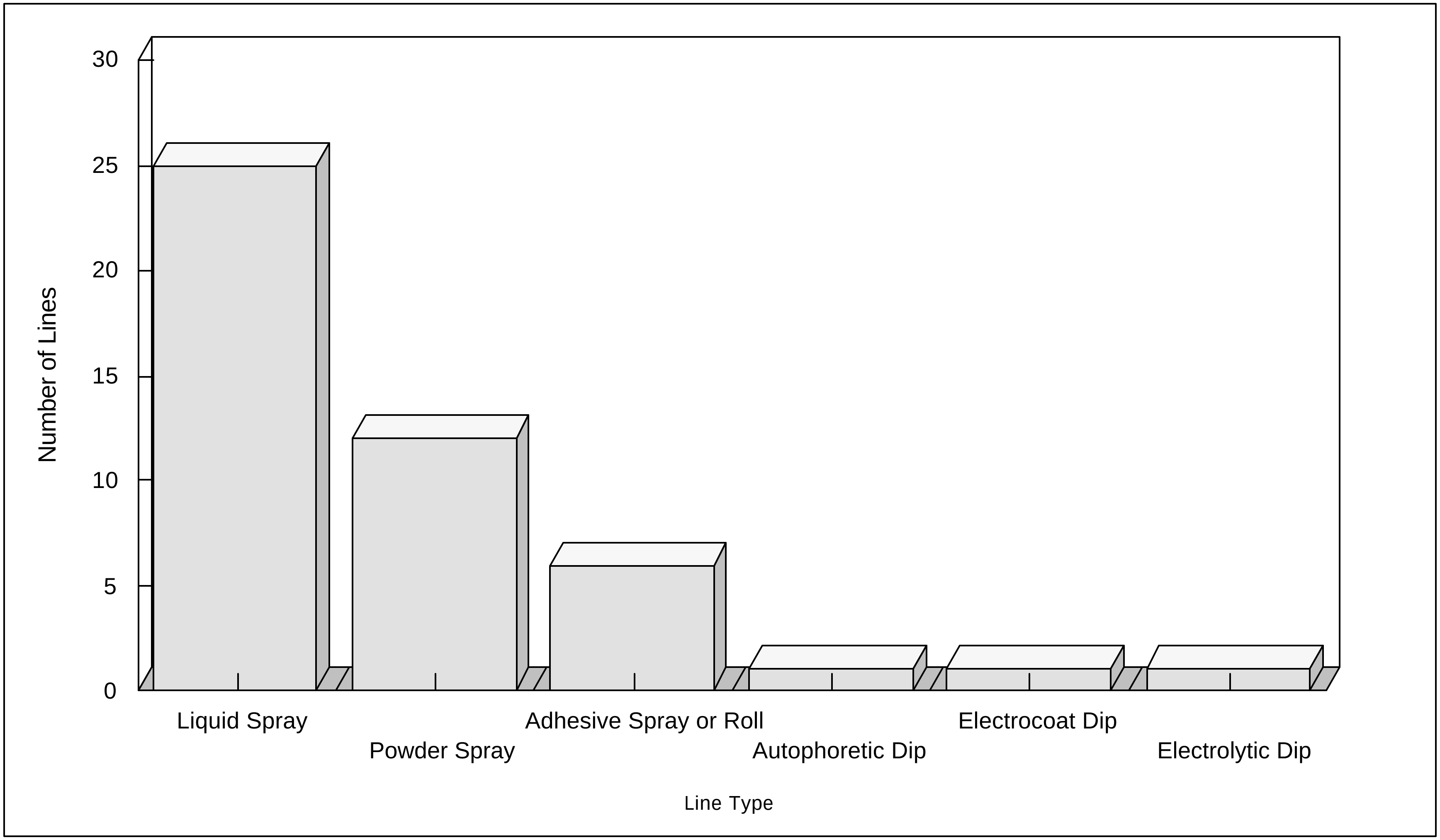


Figure 3-3. Number of Coating lines by Coating Type and Application Method

Dip coating is another available coating application method, typically used on parts that do not require a high-quality appearance, such as interior components of a filing cabinet. The parts to be coated are manually or automatically dipped into a tank containing the coating. The parts are then raised from the tank and any excess coating is allowed to drain, achieving very high coating transfer efficiencies. Typical systems have some means of recirculation of the tank contents, filters to remove paint sediment and solid contaminants, and means for controlling viscosity of the fluid. Because of the large surface area of liquid coating exposed, solvent losses occur from the tank. To maintain the desired coating viscosity in the tank, these losses are compensated by adding thinner (water or solvent, depending on the coating used).

Flow coaters were designed to overcome some of the problems associated with conventional dip coaters. The coating is applied to the parts at low pressure as they pass under a series of nozzles. Typical flow coater tanks are enclosed and are smaller than the equivalent dip coating tank. As a result, less coating is used and less solvent is evaporated than in dip tank operations. This modification results in an increase in production rate and more rapid coating color changes.

Adhesives are used primarily to attach seat cushions to the seat bottom or frame, attach cloth to seat cushions, and attach decorative laminate to wood or metal substrates for desk tops and table tops. The adhesive is typically spray applied to both the substrate and laminate, then the two parts are assembled. Spray application is used when parts with a large surface area are to be coated, such as a desk top, and the viscosity of the adhesive is low enough to pass through a spray nozzle. Roll application is used for high viscosity adhesives and for small surface areas. In most instances, the adhesive is activated by pressure, not heat.

Electrocoating is a specialized form of dip coating where opposite electric charges are applied to the coating and the part. The coating is deposited on the part by means of electrical attraction, which produces a more uniform coating on the part than traditional dip application. Autophoretic coating is a dip application method where a chemical reaction deposits the coating on the surface of the part. Emissions of organic HAPs are considerably less than a comparable liquid spray coating process. VOC emissions from the autophoretic process are negligible.[8]

Powder coatings are applied almost exclusively by means of electrostatic spray in the metal furniture industry. The electrostatic spray gun directs the flow of powder to the product. If a powder recovery system is used, the oversprayed powder is recovered and recycled (see Figures 3-4 and 3-5). Powder coatings may also be applied using a dip application operation. The part to be coated is first heated to a temperature above the powder's melting point. The hot part is then immersed in a fluidized bed of the powder, melting the powder in contact with it and forming a continuous coating on the part.

Each of the liquid and powder coatings described above is heat dried or cured after application, with the exception of adhesives which are activated by pressure. For liquid spray and dip coating operation, the coated parts are typically first slowly moved through a flashoff area after the coating application operation, which allows solvents in the coating to evaporate slowly and avoids bubbling of the coating while it is curing in the oven. The amount of organic HAP and VOC emissions from the flashoff area depends on the type of coating used, line speed, and the distance between the application area and the bake oven. For liquid spray applications, it is estimated that 65-80 percent of the volatiles are emitted during the application and flashoff operations, and the remaining 20-35 percent from the drying/curing operation.[9] However, the amount of evaporation is dependent on the type of coating and the residence time of the part in the zone. After application of the powder coating, the metal part is conveyed to an oven and heated to cure the powder. This curing process melts the powder, forming a continuous coating on the metal part. Depending on the powder coating used, the finish may be smooth or textured. Following the curing step, the final unit is assembled (if necessary) and packaged for shipment.

3.3.4 Assembly

Many metal furniture items require final assembly operations after coating. The majority of these operations are mechanical in nature, such as assembly of drawers into file cabinets and attachment of handles and decorative trim, and involve no emissions.

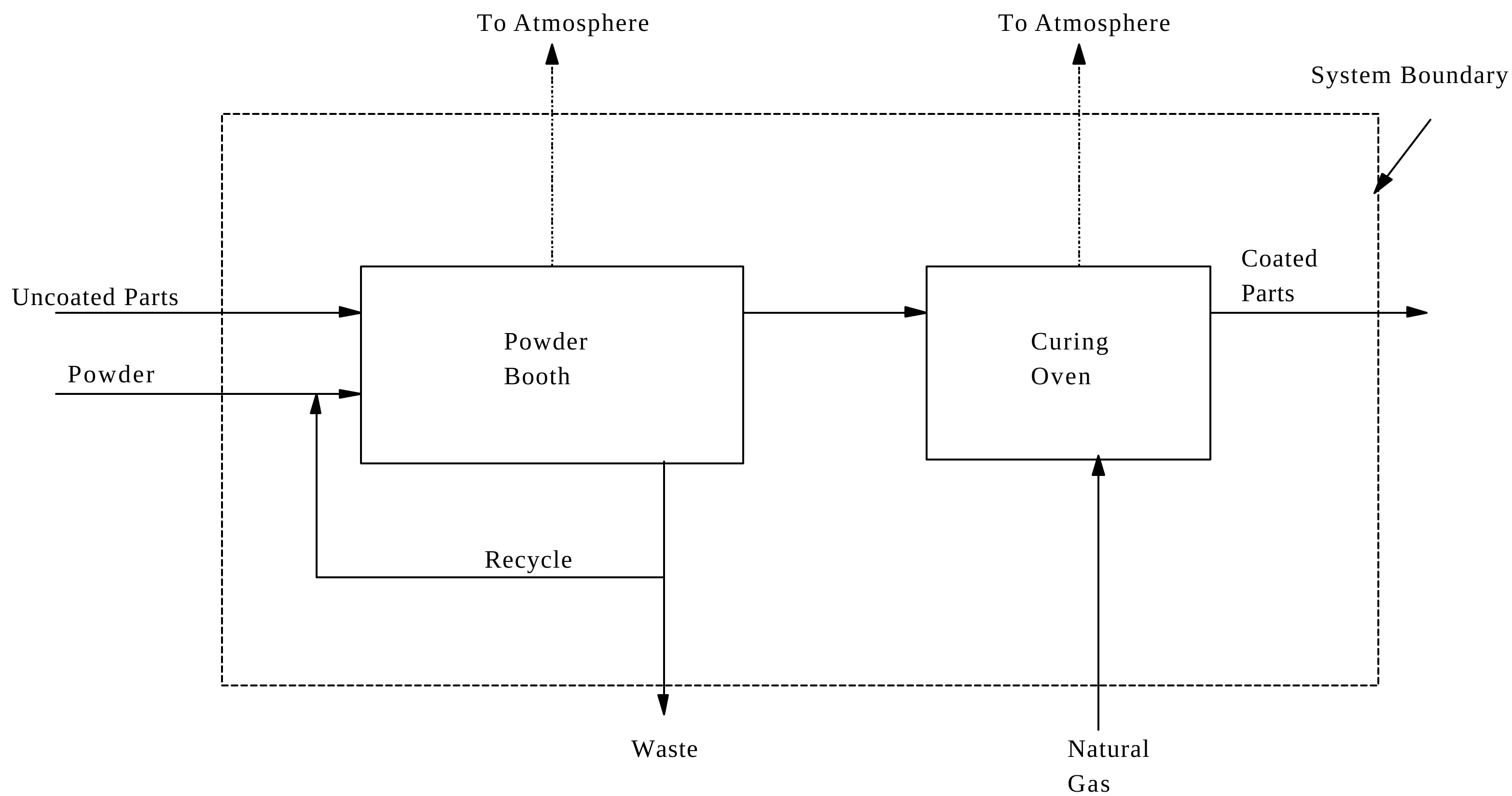


Figure 3-4. UOS for Powder Coating Application System (with recycle)

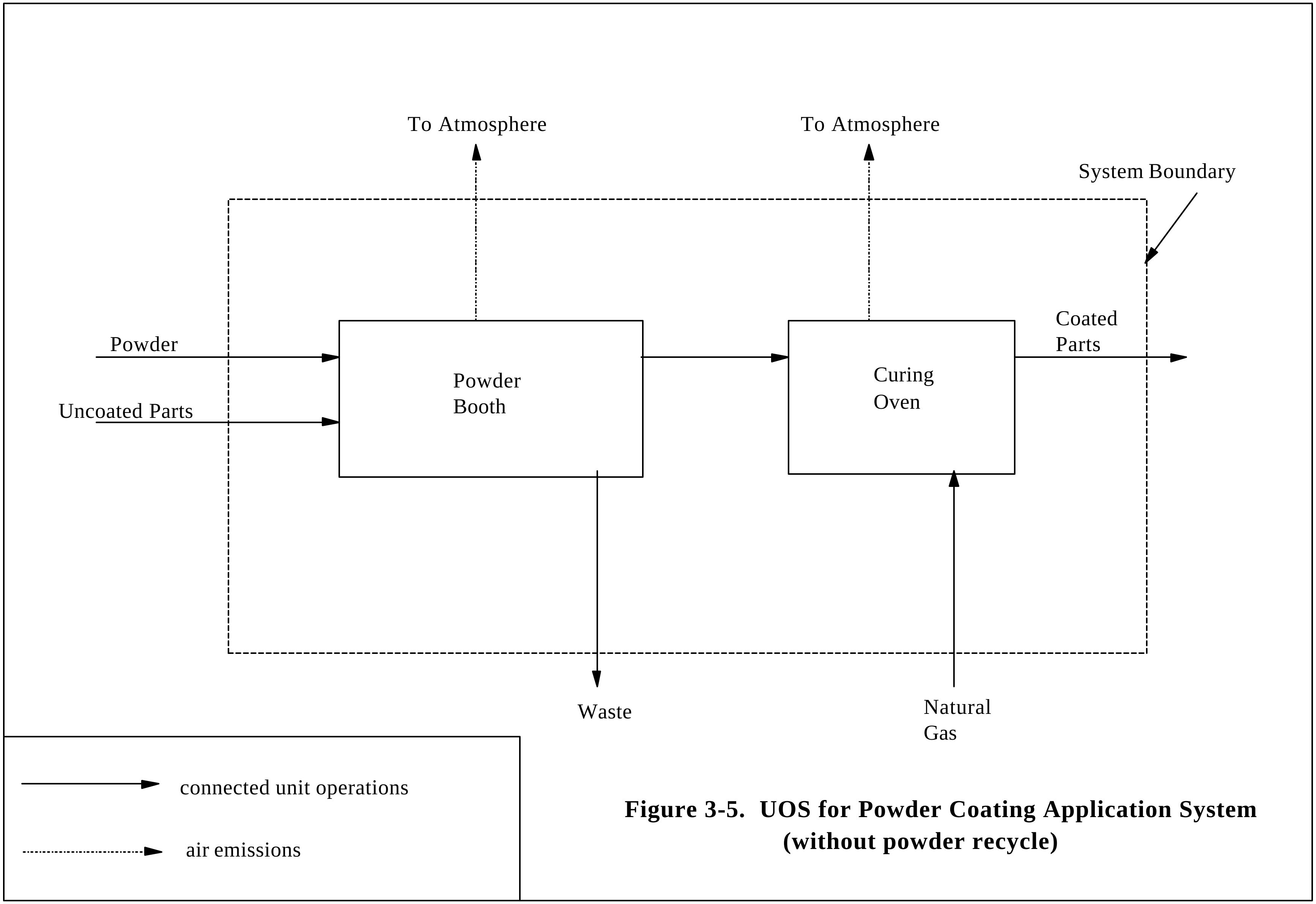


Figure 3-5. UOS for Powder Coating Application System (without powder recycle)

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4.0 EMISSION CONTROL TECHNIQUES

This chapter details techniques that are currently utilized by the metal furniture surface coating industry to control organic hazardous air pollutant (HAP) and volatile organic compound (VOC) emissions. Control techniques include pollution prevention measures such as coating substitution or reformulation from conventional solventbased coatings, solvent substitution, and the use of add-on control devices such as oxidizers, absorbers, and biorectors.

4.1 POLLUTION PREVENTION MEASURES

Pollution prevention measures including lower organic HAP content coatings, work practice procedures, and equipment modifications may be used to decrease organic HAP emissions from coating application operations. Lower organic HAP coatings, such as waterbased and higher solids content coatings, as well as powder coatings, may be used to reduce organic HAP emissions by reducing or eliminating the organic solvent present in the coating. Work practice procedures and equipment modifications may also result in pollution prevention when they reduce organic HAP emissions at the source.

4.1.1 Powder Coatings

Powder coatings have minimal organic HAP and VOC emissions (cure volatiles), generally result in a smaller waste stream, and have higher durability as compared to traditional liquid coatings.[1] Because powder coatings are applied as dry particles, no solvent-based volatiles are released during the application operation, and cure volatile emissions from the curing operation, if any, are generally much less than the volatile emissions from liquid coating systems. Typically, powder overspray is recycled and reused rather than discarded as waste (see Figure 3-4). Transfer efficiency for powder without a recovery system is estimated to be approximately 60 percent, but can be greater than 99 percent with recovery.[2]

Two types of powder coating resin materials exist: thermosetting and thermoplastic. Thermosetting powders harden during heating inside a bake oven as a result of cross-linking or polymerizing of the resin. Common thermosetting resin types include epoxies, polyesters, hybrids, polyurethanes, and acrylics.[3] Thermoplastic powders soften with the application of heat and resolidify during cooling, but continue to have the same chemical composition. Typical thermoplastic resins include polyethylene, polypropylene, nylon, polyvinyl chloride, thermoplastic polyamides, and thermoplastic polyesters. The general metal finishing industry accounts for approximately 53 percent of thermoset powder sales.[4]

Powder coating application systems used in the metal furniture industry generally consist of a powder delivery system, electrostatic spray gun system, and a spray booth. A powder recovery system may also be included. Powder delivery systems utilize pneumatic pumps to transport the powder to the spray gun. Since powder coatings contain no solvents, organic HAP and VOC emissions are eliminated during coating preparation and application as compared to conventional liquid coating systems.

Some organic HAP and VOC emissions may be released after powder coating application during the curing process (cure volatiles). Depending on the specific resin type and additives used in the powder formulation, cure volatiles may be produced by two mechanisms. First, organic components in the formulation may be volatilized when the powder is subjected to heat without undergoing a chemical reaction. The second mechanism is a chemical reaction between the additives in the powder when exposed to the heat of curing that creates organic compounds, and then these organic compounds are volatilized. The amount of cure volatiles released is dependent on many factors including resin type, cure time, and cure temperature.

Emissions may occur from the curing of powder coatings at temperatures greater than 160°C (320°F).[5] Two to six mass percent of urethane polyester powder coatings may be emitted as volatile compounds in the curing step.[6] Urethane polyester powders represent the powder type with the greatest potential for volatile emissions due to the use of isocyanate curing agents which are blocked with caprolactam. The unblocking reaction occurs when heat is applied in the curing oven, and caprolactum (which is not a HAP) is released. The typical powder type used in the metal furniture industry appears to be modified epoxy-based powders, which do not use isocyanate curing agents or caprolactam blockers. Consequently, volatile emissions from these powder coatings are expected to be considerably less than the urethane polyester powders. However, application of powder coatings may result in the release of particulate matter emissions into the surrounding atmosphere, unless these emissions are controlled.

The use of powder coatings appears to be increasing. Numerous metal furniture manufacturing facilities have converted existing liquid coating lines to powder. Powder coatings had an estimated overall growth rate in North America of 12 percent between 1992 and 1996.[7]

4.1.2 Waterbased Coatings

Waterbased coatings have recently gained acceptance as an automotive topcoat due to their lower VOC content levels and improved appearance compared to higher coating solids, solventbased coatings. This successful commercialization in the automotive industry is expected to lead to the increased use of waterbased coatings in other industries. The use of waterbased coatings is limited in the metal finishing industry because waterbased coatings tend to corrode mild steel and some stainless steels. The metal ions released from the corrosive attack can contaminate the coating and upset its chemistry.[8]

Waterbased coatings reduce organic HAP and VOC emissions due to the reduction of organic HAP and VOC contained in the coating as compared to conventional solventbased coatings. They may contain up to 80 percent water and the remaining 20 percent consists of solids, and may also include organic HAP or VOC materials. Emission reductions may be realized during coating preparation, application, and curing due to the overall reduction of organic HAP and VOC materials in the coating formulation. Some waterbased coatings may be recovered and reused, thereby decreasing organic HAP and VOC material usage.[9]

4.1.3 Solventbased, Higher Coating Solids Coatings

Conventional solventbased coatings contain 25-60 percent coating solids by volume. Higher coating solids coatings contain greater than 60 percent coating solids by volume, and use coating resins with highly reactive sites to help in coating polymerization.[10] Because less solvent is used with higher coating solids coatings, surface preparation is more critical as compared to conventional solventbased coatings. There is less solvent in the coating to self-clean the substrate surface. The surface finish achieved in the metal furniture industry with higher coating solids coatings is similar to the surface finish achieved with conventional solventbased coatings.

Organic HAP and VOC emissions are reduced through the use of higher coating solids coatings because they contain less solvent per unit volume of solids than conventional solventbased coatings. Thus, a lesser amount of organic HAP and VOC emissions are released during coating preparation, application, and curing. While higher coating solids coatings typically utilize conventional spray equipment, additional organic HAP and VOC emission reduction may be achieved during coating application due to the reduction in number of spray applications necessary to achieve a given dried film thickness on the substrate. Also, higher coating solids coatings generally achieve a higher transfer efficiency as compared to conventional solventbased coatings. These factors may lead to lower overall coating usage as compared to conventional solventbased coatings. The reduction of organic HAP and VOC material coupled with reduction in overall coating usage may lead to emission reductions of up to 50 percent, as compared to conventional solventbased coatings.[11]

4.1.4 Work Practice Procedures

It is estimated that 25 to 50 percent of all waste in furniture coating operations can be attributed to poor operation and maintenance.[12] Coating waste is generated during coating material preparation, coating application, and equipment cleaning. If coating waste is reduced, overall organic HAP and VOC emissions from coating operations will be reduced because less organic HAP and VOC coating material will be needed for production. Coating waste may be reduced by effectively controlling material preparation, maximizing the amount of coating transferred to the part through the use of more efficient application methods and proper form (spray technique), and using proper equipment maintenance procedures. Six operational factors that may impact emissions are viscosity of the coating material, air and fluid pressure, shape and size of the spray pattern, proper positioning of the workpiece, operator training, and equipment maintenance.[13]

By increasing the transfer efficiency, or percentage of coating applied to the part, less coating is needed to produce a given number of parts. This reduction in overspray and therefore, coating usage, leads to a reduction in organic HAP and VOC emissions.

The viscosity of the as-purchased (as-supplied) coating is an important parameter which affects the shelf life of a coating, whereas the viscosity of the as-applied coating affects its properties after application. There are two methods to control viscosity: thinning of the coating with a solvent or heating the coating. Typically, the less viscous the coating material the easier the atomization and thus, the easier the coating application. Heating the coating material may lead to lower organic HAP and VOC emissions, as opposed to thinning the material with a solvent, while still achieving comparable atomization results. Air and fluid pressure may also be controlled to provide optimum atomization results while reducing overspray.

Operator training plays an essential role in efficient material usage and reduction of finish defects. Operators should be trained on the proper distance from gun tip to workpiece, position of the gun tip, and spray gun triggering. Depending on the type of spray gun used, the gun tip should be held approximately 20 to 30 centimeters (8 to 12 inches) from the product. If the distance from the gun tip to the product is too great, a decreased transfer efficiency may result because the spray pattern will be too large, resulting in a greater amount of overspray. Running of the coating occurs when too much coating is applied to a small surface area of the part resulting in increased rejects. This often occurs when the spray gun is too close to the substrate. The spray gun should be held perpendicular to the workpiece to reduce uneven coating coverage.[14] It should be triggered after the stroke is started and released before the end of the stroke to reduce material usage and finish defects. Operator training should be repeated periodically to reinforce proper spray coating techniques.

Proper maintenance of equipment will also decrease material usage and defects in finished products. To minimize rejects and reworks due to defects in finished products from contamination occurring at the spray booth, the floor of the spraybooth should be periodically cleaned. Lighting conditions should be adequate to allow the painter to better view the workpiece, thereby minimizing defects from incomplete coating coverage. Turbulent air in the spraybooth should be avoided, as finish defects may be caused when dry overspray is carried on to previously coated parts. Old peelcoat on the walls and ceiling of the spraybooth should be removed when layers of dry overspray accumulate, which can land on moving parts.[15]

Spray guns should be kept clean and lubricated according to manufacturer's recommendations to ensure proper operation. If the spray gun is cleaned in solvent, only the tip of the gun should be fully immersed to avoid scale build-up in the gun. The gun spray pattern should be checked periodically for wear or clogging to ensure maximum coating transfer efficiency.[16]

4.1.5 Equipment Substitution

The use of the most effective application equipment may reduce emissions of organic HAP and VOC. Conventional systems utilize higher atomizing air pressure with typical transfer efficiencies of 25 to 40 percent. More modern technologies, such electrostatic and high volume/low pressure (HVLP) spray equipment, can achieve much higher transfer efficiencies. HVLP systems have improved nozzles which provide better air and fluid flow, which allow for more gentle atomization of the air stream. These nozzles or atomizers shape the air/spray pattern and guide the charged coating particles to the product being coated. The electrostatic attraction of the charged particles pulls them onto the part's surface. Transfer efficiencies of up to 90 percent may be achieved depending on the product shape, size, and substrate.[17] This increase in transfer efficiency translates to a decrease in usage of materials containing organic HAP and VOC.

Another spray coating application technology which can reduce emissions measurably utilizes supercritical fluid (SCF), especially carbon dioxide (CO_2), in place of organic solvents to apply coatings to metal substrates. In conventional coating formulations, solvents are used, among other things, to reduce the viscosity of the coating low enough to allow atomization to occur in the spray process. However in the SCF process, CO_2 replaces a portion of the organic solvents and is dissolved in the coating material to produce decompressive atomization.[18] Unlike the solvents it replaces, CO_2 is not an organic HAP or VOC. Using CO_2 as a coating solvent not only reduces the amount of organic HAP and VOC emissions but also reduces the amount of CO_2 gas that is emitted from coating operations. One kilogram (2.2 lbs) of organic solvent emitted to the air may eventually produces 2.0 to

3.0 kg (4.4 to 6.6 lbs) of new CO_2 as it is oxidized naturally in the environment, whereas with supercritical CO_2, the solvent is replaced by 1.0 kg (2.2 lbs) or less of by-product carbon dioxide.[19] Volatile emissions in commercial applications of the SCF spray process using a variety of resin types have been reduced from 50 to 89 percent.[20] However, CO_2 does not work for a few resin systems.

4.2 POLLUTANT ABATEMENT AND RECOVERY DEVICES

In addition to pollution prevention measures, organic HAP and VOC emissions from coating application operations can be reduced by recovering and reusing overspray or the use of add-on control devices.

4.2.1 Recovery of Coating Overspray

Spray booths are typically equipped with dry filters or waterwash to control overspray. A less common alternative is to modify the back of the spray booth with a series of baffles that run the height of the spray booth and are several inches wide. These baffles overlap each other, forcing the overspray-laden air to change direction several times. The overspray droplets carried in the air are collected on the baffles. As the coating builds up on the baffles, it drips into collection troughs under the baffles and can be collected for reuse. This reduces overall emissions because instead of the overspray becoming waste, it is collected and reused, thereby reducing the overall amount of new organic HAP and VOC material used in the coating application operation.

4.2.2 Add-on Control Devices

Organic HAP and VOC emissions from coating application and curing operations can be reduced through the use of add-on control devices. While add-on control devices are available to the industry, the EPA is aware of only a few cases where add-on control technologies are utilized in the metal furniture surface coating industry. Technologies applicable to the control of organic HAP and VOC emissions include oxidation, absorption, adsorption, and bioreactors (biofilters).

4.2.2.1 Thermal oxidation. Organic HAP, VOC, CO, and condensable organic particulate matter emissions in an air stream may be destroyed by exposure to an oxidizing atmosphere at high temperatures. Oxidizers may be of thermal or catalytic design and may use primary or secondary heat recovery to reduce energy consumption. Catalytic oxidizers employ a catalyst to aid in the oxidation reaction, which helps lower the required combustion temperature relative to that achieved in thermal oxidizers. Both types of oxidizers generally utilize either regenerative or recuperative techniques to preheat inlet gas in order to decrease energy costs associated with high oxidation temperatures.

In general, thermal oxidizers may achieve destruction efficiencies of greater than 95 percent as applied to coating application operations with high and constant concentrations of organic emissions.[21] Primary heat recovery ranges from approximately 55 to 95 percent.[22,23]

4.2.2.2 Absorption. The process of absorption consists of contacting a gas stream with a liquid so that one or more of the components of the exhaust stream will dissolve in the liquid. Water is the most common absorbent, but organic solvents may also be used. Removal efficiency can be enhanced by the addition of reactive chemical additives to the absorbent to increase solubility of the absorbed pollutant or change the equilibrium. Some particulate matter may also be removed by the liquid, although excessive particulate matter can lead to plugging.

4.2.2.3 Adsorption. The unbalanced molecular forces on the surface of solids attract and retain gases and particulate matter that come in contact with the solid. This phenomenon is known as adsorption. Several materials are widely used as the adsorbent, such as activated carbon, organic resin polymer, and inorganic materials.[24] Each has substantial surface area per unit of volume. Adsorption has been used for coating application operation exhaust streams at ambient temperature to approximately 38°C (100°F).[25]

Carbon adsorption removal efficiency is dependent upon several factors, including the flow rate of the inlet air stream, the inlet concentration of the pollutant, the chemical and physical characteristics of the pollutant, and the bed design. Existing systems have generally been designed for efficiencies between 90 to 95 percent, although efficiencies of up to 99 percent can be achieved in some cases.[26]

4.2.3 Other Applicable Add-on Control Technologies

This section describes several add-on control technologies which are not currently utilized by the metal furniture surface coating industry. However, they are applicable control technologies for organic HAP emissions from coatings.

4.2.3.1 Biodegradation. Low concentrations of organic materials in exhaust streams can be removed through the use of biodegradation. A biodegradation system first involves dissolving the organic materials in a liquid phase. Microorganisms then metabolize the organic materials, aiding in their biodegradation. The organic material is oxidized at close to room temperature and breaks down into carbon dioxide, water, and other byproducts.[27]

4.2.3.2 Condensation. Organics can be removed from gas streams by cooling the gas to a temperature less than the dew point of the organics. The gas may be cooled with indirect or direct heat exchangers. The typical coolant is cold water. For low concentration streams (less than about 1 percent or 10,000 ppmv), refrigerant coolants are required. Some particulate matter in the gas stream may also be removed, generating a condensate sludge.

4.2.3.3 UV Oxidation. Oxidants such as ozone and peroxide mixed with organics in an air stream are irradiated with ultraviolet (UV) light to produce highly reactive hydroxy and oxygen radicals. These radicals then react with the organics in the air stream, converting them into carbon dioxide and water. The chemistry of this process is similar to that by which sunlight degrades organics in the atmosphere.

UV/ozone oxidation technology has been successfully demonstrated for control of coating application operation emissions.[28] This technology can achieve VOC destruction efficiencies of greater than 95 percent.

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5.0 NATIONWIDE BASELINE CHARACTERISTICS AND MODEL PLANTS

The purpose of this chapter is to present the nationwide baseline characteristics of the metal furniture surface coating industry and the methodology used to estimate each characteristic. This chapter also presents the methodology used to characterize model plants to represent the industry. The different types of model plants (based on size) were first determined, and then the values of model plant parameters that affect the level of emissions were calculated. The baseline characteristics, along with the model plants, provide a reference point against which impacts of regulatory alternatives being considered are compared in Chapters 7 through 9.

5.1 INTRODUCTION

Because of the large number of facilities in the metal furniture source category, a plant-specific estimation of impacts was not feasible. Therefore, a model plant approach was selected to estimate the impacts. A model plant does not represent any single actual facility, but rather it represents a range of facilities with similar features that may be impacted by the standards. Each model plant is characterized in terms of facility size and other parameters that affect estimation of emissions, control costs, and secondary environmental impacts. This approach works well even when there are a large number of facilities involved, as in the metal furniture surface coating source category. It is also an efficient approach for estimating plant-level and nationwide impacts of control options when reliable data from all potentially impacted facilities in a source category are not available or are difficult to obtain, which is the case for the metal furniture source category. Thus, the use of model plants provides a reasonable estimate of plant-level and nationwide impacts of control options that are representative of the source category without having to simulate the effects of applying control options on all potentially impacted facilities in the source category. The control options are similar across the model plants and are technically feasible for all sizes of facilities, including small businesses. The model plant approach will, therefore, provide impact estimates that are representative of the source category. The model plants developed for this source category incorporate the baseline characteristics presented here.

5.2 DATA SOURCES

The primary data source used to estimate the total number of metal furniture facilities was the 1997 U.S. Census Bureau's Economic Census, Manufacturing Industry Series[1] because it provided the most comprehensive determination of the number of facilities by Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes. To determine the percentage of facilities located in urban and rural areas, the American Business Index (ABI) database[2] was utilized because this is the only comprehensive listing of facility names and addresses by SIC code that was found (at the time this analysis was performed, no databases were found that linked NAICS codes with facilities names and addresses). Then, the EPA's Toxics Release Inventory (TRI) database[3] was used to determine the split between major and area sources.[4] The TRI database was the only database found that provided speciated emissions data organized by facility name and also included addresses and SIC codes (the TRI database did not include NAICS codes). The primary data source for estimating emissions was the database created from the responses to the industry questionnaires conducted in June 1997 and June 1998. The only other readily available and comprehensive database of HAP emissions information by SIC or NAICS code was contained in the TRI database. The questionnaire database was selected over the TRI database because the questionnaire responses contained detailed information by unit operation and represented the most accurate detailed information available. The following sections discuss each data source in more detail.

5.2.1 Economic Census

The Economic Census provides a variety of information arranged by NAICS code. The census data were used to determine the total number of facilities for each of the NAICS codes relevant to the metal furniture industry.

Fifteen Standard Industrial Classification (SIC) codes that include metal furniture parts or products were identified. Six of these codes deal almost exclusively with metal furniture products (see Appendix C, Table C-1). The other nine codes deal with a mixture of metal furniture products, as well as products for numerous other industries (see Appendix C, Table C-2). While the first six SIC codes constitute the majority of the industry, all of the 15 SIC codes will probably contain facilities affected by the rule. Consequently, the baseline emissions and economic estimates must take into account these other nine relevant SIC codes, even though they contain some facilities that do not produce metal furniture. Once the NAICS codes were made publicly available, the NAICS codes corresponding to each of these 15 SIC codes were determined. The NAICS codes were then used to obtain the Economic Census data. Appendix C, Table C-3 shows the relationship between SIC codes used to obtain the Economic Census data and the NAICS codes, published after 1997. Section 5.3.2 explains how the Economic Census data were used to estimate the number of metal furniture facilities.

5.2.2 American Business Index (ABI) Database

The ABI database can be searched using numerous criteria, such as facility name, city where the facility is located, sales volume, and SIC code (NAICS codes were not listed in the ABI database). We chose SIC code for consistency with the U.S. Census Bureau data. Up to four SIC codes can be listed for each facility in the ABI database. Only the primary SIC code was used for this search in order to avoid double counting of facilities. For example, many facilities were listed with both SIC code 3645 (residential electric lighting fixtures) and SIC code 3646 (commercial lighting fixtures). If the search was not limited to the primary SIC code, then these facilities would have been counted under each of the SIC codes. This would have led to inflated estimates of the total number of facilities.

The ABI search yielded a list of facilities for each SIC code, along with the facility's address. From this information, the location of each facility and whether this location was in an urban or rural area was determined.

5.2.3 Toxics Release Inventory (TRI) Database

The TRI database was searched using the SIC codes in Appendix C, Tables C-1 and C-2 as the basis of the search (the TRI database does not list NAICS codes). This search yielded site-specific TRI information for each facility, including speciated emissions data. Using these emissions data, each facility's total HAP emissions were determined by summing the information tabulated under the point and fugitive (not captured) emission values for each HAP in the speciated emissions data.

The TRI database may include multiple SIC codes for each facility. It was not possible to limit the search to only the primary SIC code, as with the ABI database. Therefore, to avoid double counting, the TRI listings for each SIC code were cross-referenced, and duplicate entries were removed.

5.2.4 Industry Questionnaires

Questionnaires were sent to a total of 39 companies, including both the June 1997 and June 1998 questionnaires. Responses were received from 85 individual facilities. Of these 85 facilities, 59 were determined to be in the metal furniture source category. The industry questionnaire response database contains the information provided by these 59 facilities. The database was further refined by separating the area sources from the major sources. In order to be classified as an area source, not only did the facility have to have HAP emissions below the 9.1/22.7 megagrams per year (10/25 ton per year) major source threshold, but also be technologically limited from exceeding the threshold. Technologically limited means that the facility does not have the capacity to emit HAP at a level equal to or greater than the major source HAP threshold from the existing collocated operations that are under common control. For example, a facility with total HAP emissions of 1 Mg/yr that applies only powder coatings and maintains no liquid coating application operations or other major emitting collocated operations would be judged to be technologically limited from exceeding the major source threshold. A number of the facilities in the database that were judged to be area sources of HAP used powder coatings exclusively. This analysis showed that 49 facilities in the questionnaire database were major or synthetic minor.[5]

Of the 49 major or synthetic minor facilities left in the database, 22 provided complete information on their cleaning and coating operations such that total organic HAP emissions and total coating solids usage could be calculated. The information provided by these 22 facilities was used to estimate baseline emissions.

5.3 MODEL PLANT DEVELOPMENT

5.3.1 Selection of Model Plants

The affected source for estimating the impacts of previous metal furniture surface coating standards[6] was limited to the coating application, flashoff, and curing operations. Therefore, the model plants developed to aid in the estimation of the impacts of these previous rules were limited to these same operations. The EPA considered a broader affected source in this rulemaking, so the model plants represent the combination of all unit operations (see section 5.3.3 for a description of the unit operations) associated with coating application and cleaning operations. The basic approach was to develop a small number of model plants that reflect the combination of unit operations found at typical facilities, rather than numerous model plants that include only a single unit operation (such as a series of model plants for cleaning operations and a series of model plants for coating application and curing operations). This provided the flexibility to evaluate regulatory alternatives that allow compliance to be determined across all coating application, cleaning, and related operations at a facility.

The most logical parameter on which to distinguish model plants was size. However, there are many ways to measure size. Annual sales was considered to be a determining factor of size, but it was rejected because one facility could produce a high volume of low-priced products, while another produced a low volume of high-priced products. The overall annual sales of these two facilities may be similar, but other representative parameters or characteristics would be very different. The number of employees at a facility was also considered to be a determining factor of size but was rejected because it may not take into account the level of automation.

Surface area coated provides the best indicator of size for the purpose of estimating emissions because it is directly related to the amount of coating used. However, available data on surface area coated on a facility basis were limited. A parameter for which data were available that serves as a surrogate for amount of surface area coated was the volume of coating solids (nonvolatiles) used. In general, the dry film coating thickness is relatively uniform across metal furniture product types such that the volume coating solids used is an adequate indicator of size for the model plants.

To span the range of types and sizes of facilities in the source category, three model plants were developed. These model plants were distinguished by size as measured by the total volume coating solids used. The three model plants are referred to as small, medium, and large. Figure 5-1 presents the coating solids usage for the facilities in the industry questionnaire database, ranked from lowest to highest usage. The facilities fell into two general groups–facilities with coating solids usage above 100,000 liters per year and those below. Based on the knowledge of the industry gained primarily through site visits, these two groups did not appear to adequately describe the range of facility sizes observed. Therefore, three groups were developed.

The first was for small facilities similar to ones observed during the site visits. From information obtained during the site visits, the coating solids usage for small facilities (i.e., primarily privately held companies consisting of a single manufacturing location) could be very low, in some cases no more than about 1,000 liters/yr. However, the coating solids usage is highly dependent on the type of coating used. For example, a lacquer, which is a solution of high molecular weight polymers, will need more solvent to dissolve the polymer. Hence, it will contain much less coating solids than a two-reactant coating system that polymerizes after application. The type of product produced and production volume are two other parameters that will also affect the coating solids usage. Based on these factors, an upper limit for coating solids usage of 40,000 liters/yr for this type of small facility was believed to be reasonable and was used to define the upper limit of the small model plant. This is also shown in the large cluster of facilities in Figure 5-1 below the 40,000 liter/yr level.

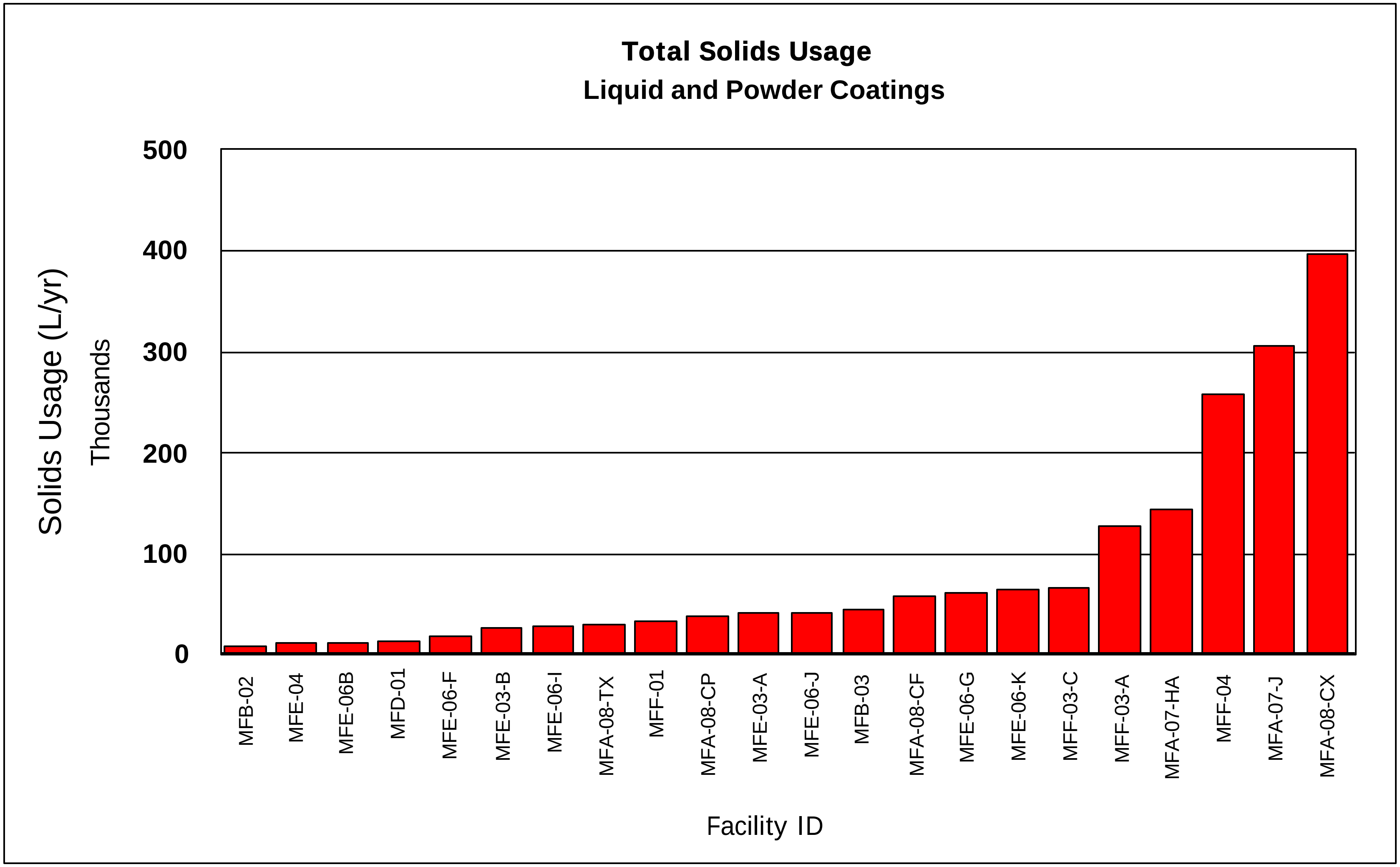

Figure 5-1. Total Coating Solids Usage by Facility for Liquid and Powder Coatings

The next model plant to be defined was the large model plant. This model plant is characterized by the larger, corporate-owned facilities that produce large quantities of standard metal furniture products, typically for home and office use. Based on site visits and the information in Figure 5-1, this model plant was best defined as using 100,000 liters/yr or more of coating solids.

For the remaining facilities, those using between 40,000 and 100,000 liters/yr of coating solids, no distinguishing requirements in terms of coatings used or products produced were observed to warrant further division. Thus, this group was selected as representative of the medium model plant.

5.3.2 Nationwide Number of Facilities

The total nationwide number of facilities corresponding to each model plant size was estimated using the U.S. Census Bureau's Economic Census data.[7] The facilities in the Toxic Release Inventory System (TRIS) database[8] were then used to determine the overall percentage of major and minor (area) sources of organic HAP emissions in the metal furniture manufacturing industry. The percentage of major sources from the TRIS database was applied to the total number of sources in the census data to give a nationwide estimate of 655 major sources.[9] Then, the nationwide number of facilities that fell into the small, medium, and large model plant categories was determined based on the corresponding size distribution of facilities in the industry questionnaire responses. The small model plant group accounted for 45 percent of the facilities, while the medium and large model plant groups accounted for 32 and 23 percent, respectively. Using these percentages, the estimated nationwide number of major sources by model plant size was 295 small, 209 medium, and 151 large facilities.

The Economic Census data were used as the primary source of information for the number of metal furniture facilities in the United States. A search was performed for each of the SIC codes listed in Appendix C, Tables C-1 and C-2 (when this search was performed, NAICS codes were not included in the Census data). While this search could have been limited by using number of employees (for example, excluding facilities with less than 5 employees on the assumption that they would not be major sources), the decision was made to include all facilities, regardless of size, because the Economic Census data do not contain information that can be used to estimate emissions. Instead, the distinction between major and area sources was made using the TRI data as described below.

Three of the SIC codes in Appendix C, Table C-2 were not considered after reviewing the Economic Census data. Two of these SIC codes, 3499 and 3999, represent general categories of facilities that cannot be classified under more specific codes. Many of the non metal furniture products under these SIC codes would likely be regulated under the miscellaneous metal parts and products source category. It is expected that there will only be a few metal furniture manufacturers that could not be classified under the remaining codes identified in Appendix C, Table C-1 and C-2. Because of the large number of facilities listed under these two SIC codes and that many of the facilities would clearly be outside of the scope of the metal furniture source category, including them in the baseline number of facilities would bias the estimate of nationwide impacts. Consequently, excluding these two codes will not have a significant effect on the estimate of the nationwide number of facilities. For the third SIC code, 7641, census data were not available on facilities by primary SIC code. Appendix C, Table C-4 lists the estimated number of facilities for the remaining SIC codes.

A major drawback of using the Economic Census data is that it provided no information on the level of emissions. Such information was needed to determine the number of major sources (the number of sources that will be affected by the proposed rule). The TRI database was used to determine emissions because it was the most readily available source of speciated HAP emissions data on a facility basis. The TRI database does have limitations (e.g., not all section 112(b) HAP are included under TRI), but it was the best source of speciated emissions that was readily available.

The TRI database was searched using each of the metal furniture SIC codes (TRI data by NAICS codes were not available). For each facility returned under these searches, the speciated air emissions data were obtained. The TRI "point" and "fugitive" emissions for each HAP were summed and then the result was compared to the 9.1/22.7 megagrams per year (10/25 tons per year) major source threshold. If the HAP emissions were above the threshold, the facility was considered to be a major source. The percentage of TRI-reporting facilities that were major sources was then calculated, as well as the percentage that were area sources. Applying these values to the number of facilities obtained from the Economic Census data, an estimate was made of the total number of major and area sources nationwide. These values are presented in Appendix C, Table C-5.

To determine the number of area sources located in urban areas, the ABI facility lists by SIC code were utilized (census data could not be used because it does not list individual facility names or addresses). For each SIC code, 10 percent of the facilities were randomly selected and a determination was made as to whether they were located in an urban area.[10] A sample of 10 percent was chosen because available resources were insufficient to check each of the listed facilities. For each SIC code, the percentage of facilities located in urban areas was calculated, then applied to the total number of facilities from the Economic Census data. Appendix C, Table C-5 presents the estimates of the total nationwide number of major sources, area sources, and area sources in urban areas.

5.3.3 Model Unit Operations

A unit operation is an industrial operation classified according to its function in the manufacturing process. For the purposes of the model plant and impacts analyses, the following unit operations were considered:

- Cleaning
- Coating application and curing
- Mixing and storage
- Handling and conveyance of waste materials

These unit operations cover all areas of a facility that organic HAP emission control methods affect. Thus, by adequately describing each of these unit operations and defining their input and output parameters on a model plant basis, an estimate can be made of the impacts the control methods will have on the model plants.

5.3.3.1 Cleaning Unit Operations. Cleaning unit operations encompass all production-related cleaning activities within the model plant. The production-related cleaning activities include cleaning of the item being produced (including raw materials and component parts before assembly or subassembly operations), as well as cleaning of equipment (such as spray guns, spray booths, roll coaters, and mixing and storage tanks). Janitorial cleaning is excluded.

5.3.3.2 Coating Application and Curing Unit Operations. The coating application and curing unit operation system includes coating application, flashoff, and drying or curing. The coating applied may be liquid or solid (powder) and the term coating includes adhesives. It may be applied in a booth or other enclosure by spray, dip, brush, roll, or any other means of transferring the coating to the substrate. For determining the emissions, the system of unit operations includes the application unit and flashoff area (which is the period between coating application and the curing or drying step). It also includes the drying or curing unit operation, whether accomplished by air drying or in an oven. However, when any add-on control system is used the coating emissions that are captured and destroyed will need to be accounted for and subtracted from the total emissions from the coating.

5.3.3.3 Mixing and Storage Unit Operations. These unit operations encompass all mixing and storage operations that involve organic HAP-containing materials, such as coatings, solvents used for thinning or cleaning, and other cleaning materials. Conveying of coating and cleaning materials from storage areas to mixing areas or to the coating application areas are also included and represent subcategories of these unit operations.

5.3.3.4 Handling, Conveying, and Treating of Waste Materials. This unit operation is comprised of all equipment used to handle and treat organic HAP-containing waste materials (such as waste paint and solvents) produced by the metal furniture coating and cleaning unit operations.

5.3.4 Selection of Model Plant Parameters

The model plant parameters are the values that will be used to estimate the impacts on a model plant level. These parameters, shown in Table 5-1, describe the raw material usage and operational parameters of each of the three model plants.

The industry questionnaire response database was the primary source of data for the model plant parameters. Since model plant size was based on total volume of coating solids used, those facilities that did not provide complete information on coating solids content of their coatings were not used to determine model plant parameters. Of the 49 facilities in the database, 22 provided complete coating solids information and adequate information to calculate an emission rate. The 22 facilities were divided into three groups, each one containing the facilities that fell into the range of coating solids corresponding to small, medium, and large model plants (see Tables 5-2 through 5-7).

For each model plant parameter (e.g., cleaning material usage), the arithmetic average of the values from each group of facilities was used. Where the parameter described discrete items, such as coating application lines, the average value was rounded to the next highest integer. Rounding of the average model plant parameters was done in this way in order to provide a more conservative estimate of the impacts. For example, an average value of 1.25 coating application lines per model plant would be rounded to two coating lines. The resulting cost impacts would then reflect the cost of applying control options to two coating application lines, rather than just one.

Table 5-1. Summary of Model Plant Parameters
Based on Questionnaire Response Information[a]

Parameter	Small Model Plant <40,000 liters/yr	Medium Model Plant 40,000 - 99,999 liters/yr	Large Model Plant >99,999 liters/yr
Cleaning Unit Operations			
Cleaning Material Usage (L/yr)	3,000	1,500	90,000
Coating Application Unit Operations			
Liquid Coating Usage (L/yr)	66,000	160,000	440,000
Powder Coating Usage (L/yr)	950	3,600	11,000
Powder Coating Usage[a] (kg/yr)	1,300	5,100	16,000
Coating Solids[b] From Liquid Coatings (L/yr)	21,000	50,000	240,000
Coating Solids From Powder Coatings (L/yr)	950	3,600	11,000
Total Coating Solids (L/yr)	22,000	54,000	250,000
Number of Liquid Coating Lines	2	2	4
Number of Powder Coating Lines	1	1	1

[a] An average powder coating density of 1.41 kg/liter was used to convert from liters to kilograms.
[b] Nonvolatiles (film formers).

Table 5-2. Summary of Cleaning and Coating Application Unit Operations Material Usage and Emissions Data for Facilities in the Small Model Plant Designation[a]

Facility ID	Cleaning Material Usage (L/yr)	Liquid Coating Usage (L/yr)	Powder Coating Usage (L/yr)	Coating Solids from Liquid Coatings (L/yr)	Coating Solids from Powder Coatings (L/yr)	Total Coating Solids Usage (L/yr)	Total HAP Emissions (kg/yr)	Total VOC Emissions (kg/yr)	Normalized Facility Emissions (kg HAP/L coating solids)
MFA-08-CP	6,057	73,080	0	37,892	0	37,892	4,186	12,131	0.110
MFD-01	0	8,417	9,450	3,114	9,450	12,564	1,481	3,241	0.118
MFF-01	0	93,992	0	33,014	0	33,014	5,481	5,769	0.166
MFE-06-I	0	114,335	0	27,669	0	27,669	4,910	4,910	0.177
MFE-06-F	2,214	64,988	0	17,656	0	17,656	11,202	11,202	0.634
MFE-06B	0	97,663	0	12,319	0	12,319	13,297	65,943	1.079
MFE-04	0	37,654	0	12,025	0	12,025	1,771	4,142	0.147
MFA-08-TX	7,589	50,972	0	28,706	0	28,706	7,771	18,377	0.271
MFB-02	13,948	27,339	0	8,750	0	8,750	3,857	12,453	0.441
MFE-03-B	0	94,504	0	24,766	0	24,766	21,061	26,240	0.850
Average	2,981	66,294	945	20,591	945	21,536	7,502	16,441	0.399

[a] Source: 1997 and 1998 industry questionnaire responses.

Table 5-3. Summary of Cleaning and Coating Application Unit Operations Material Usage and Emissions Data for Facilities in the Medium Model Plant Designation[a]

Facility ID	Cleaning Material Usage (L/yr)	Liquid Coating Usage (L/yr)	Powder Coating Usage (L/yr)	Coating Solids from Liquid Coatings (L/yr)	Coating Solids from Powder Coatings (L/yr)	Total Coating Solids Usage (L/yr)	Total HAP Emissions (kg/yr)	Total VOC Emissions (kg/yr)	Normalized Facility Emissions (kg HAP/L coating solids)
MFF-03-C	988	96,142	0	65,338	0	65,338	6,154	26,887	0.094
MFE-06-K	0	206,006	0	63,862	0	63,862	6,300	6,300	0.099
MFA-08-CF	6,664	99,849	0	57,640	0	57,640	13,910	23,580	0.241
MFB-03	2,991	74,959	0	45,717	0	45,717	22,880	26,268	0.500
MFE-03-A	0	188,879	8,635	32,097	8,635	40,732	22,362	51,890	0.549
MFE-06-J	0	148,162	0	41,041	0	41,041	24,713	24,713	0.602
MFE-06-G	0	333,754	16,399	45,113	16,247	61,360	41,046	176,540	0.669
Average	1,520	163,964	3,576	50,115	3,555	53,670	19,624	48,025	0.393

[a] Source: 1997 and 1998 industry questionnaire responses.

Table 5-4. Summary of Cleaning and Coating Application Unit Operations Material Usage and Emissions Data for Facilities in the Large Model Plant Designation[a]

Facility ID	Cleaning Material Usage (L/yr)	Liquid Coating Usage (L/yr)	Powder Coating Usage (L/yr)	Coating Solids from Liquid Coatings (L/yr)	Coating Solids from Powder Coatings (L/yr)	Total Coating Solids Usage (L/yr)	Total HAP Emissions (kg/yr)	Total VOC Emissions (kg/yr)	Normalized Facility Emissions (kg HAP/L coating solids)
MFA-07-J	0	629,321	0	305,693	0	305,693	39,476	132,013	0.129
MFA-08-CX	55,304	662,726	0	396,862	0	396,862	68,901	165,614	0.174
MFF-03-A	14,780	188,149	0	127,866	0	127,866	52,448	52,448	0.410
MFF-04	91,631	611,459	0	258,522	0	258,522	118,705	179,684	0.459
MFA-07-HAZ	286,983	128,681	53,085	89,666	53,085	142,751	182,651	220,185	1.280
Average	89,740	444,067	10,617	235,722	10,617	246,339	92,436	149,989	0.490

[a] Source: 1997 and 1998 industry questionnaire responses.

Table 5-5. Summary of Number of Employees, Operating Schedules, and Number of Coating Lines for Facilities in the Small Model Plant Designation[a,b]

Facility ID	Total Number of Employees	Operating Schedule		Number of Coating Lines	
		Hours/Day	Days/Week	Liquid	Powder
MFC-02	130			1	1
MFE-04	130			2	1
MFB-02	475			1	
MFA-11B	100	18	5.5		
MFE-06B	75			1	
MFD-01	227			1	1
MFA-11A	527	16	5		
MFE-03B	343			2	
MFE-06F	103			1	
MFA-08-TX	91			2	
MFF-05A	498	24	6	3	1
MFE-06I	96			1	
MFF-05B	433	24	6	2	2
MFA-08-CP	720			1	2
MFF-01	240			1	
MFE-06D	314			1	

[a] Source: 1997 and 1998 industry questionnaire responses.
[b] Where no entry is made in this table, the information was not supplied by the facility in their questionnaire response.

Table 5-6. Summary of Number of Employees, Operating Schedules, and Number of Coating Lines for Facilities in the Medium Model Plant Designation[a,b]

Facility ID	Total Number of Employees	Operating Schedule		Number of Coating Lines	
		Hours/Day	Days/Week	Liquid	Powder
MFA-08-CF	582			2	
MFA-08-GA	300			2	
MFB-03	203			1	
MFE-03A	650			4	1
MFE-06G	900			2	1
MFE-06J	171			3	
MFE-06K	270			1	
MFF-03C	116			1	

[a] Source: 1997 and 1998 industry questionnaire responses.
[b] Where no entry is made in this table, the information was not supplied by the facility in their questionnaire response.

Table 5-7. Summary of Number of Employees, Operating Schedules, and Number of Coating Lines for Facilities in the Large Model Plant Designation[a,b]

Facility ID	Total Number of Employees	Operating Schedule		Number of Coating Lines	
		Hours/Day	Days/Week	Liquid	Powder
MFF-03A	265			1	
MFA-07-HAZ	285			2	1
MFF-04	490			5	
MFA-07-J	620	24	6	4	
MFA-08-CX	659			4	

[a] Source: 1997 and 1998 industry questionnaire responses.

[b] Where no entry is made in this table, the information was not supplied by the facility in their questionnaire response.

5.4 NOTES AND REFERENCES

1. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census, Manufacturing: Industry Series (Various Reports). Washington, DC. U.S. Government Printing Office.

2. American Business Index Database, 1996/1997. First Edition. American Business Information Incorporated. Omaha, Nebraska.

3. U.S. Environmental Protection Agency. Toxic Release Inventory System. http://www.epa.gov/enviro/html/tris/tris_query_java.html. Accessed June 1997.

4. Section 112(a)(1) of the CAA defines a major source as a stationary source that emits or has the potential to emit 9.1 Mg/yr (10 tons/yr) of any HAP or 22.7 Mg/yr (25 tons/yr) of any combination of HAP. An area source is any stationary source that is not a major source.

5. A synthetic minor source is a source that would be a major source if uncontrolled, but limits its emissions below the major source thresholds with controls that must remain in place under an enforceable commitment.

6. Surface Coating of Metal Furniture - Background Information for Proposed Standards. Draft. EPA-450/3-80-007a. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. September 1980.

7. Reference 1.

8. Reference 3.

9. For a more detailed explanation of this procedure, see the following: Memorandum from Hendricks, D., EC/R Incorporated to Serageldin, M., EPA:ESD. July 10, 2000. Revised August 28, 2001. Nationwide Baseline Characteristics of the Metal Furniture Industry.

10. The Office of Management and Budget's (OMB) definition of Metropolitan Statistical Area (MSA) was used to delineate urban areas. OMB defines an MSA as 1) one city with 50,000 or more inhabitants, or 2) a Census Bureau-defined urbanized area (of at least 50,000 inhabitants) and a total metropolitan population of at least 100,000 (75,000 in New England). For more information, see the Census Bureau's Internet site at http://www.census.gov/population/www/estimates/aboutmetro.html.

6.0 REGULATORY APPROACH

6.1 INTRODUCTION

This chapter presents the methodology used to determine maximum achievable control technology (MACT) floors for existing and new major sources[1] of hazardous air pollutant (HAP) emissions in the metal furniture surface coating source category. Based on this methodology, the MACT floor for existing major sources would be 0.12 kg organic HAP/liter coating solids (nonvolatiles) used (1.0 lb/gal), and for new and reconstructed major sources the MACT floor would be 0.094 kg organic HAP/liter coating solids used (0.78 lb/gal). Regulatory alternatives more stringent than the MACT floor level of control for existing sources are discussed in Section 6.4, but none of the regulatory alternatives was determined to be feasible.

The metal furniture surface coating source category encompasses facilities that apply coatings in the manufacture of metal furniture or component parts of metal furniture. Metal furniture means furniture or components of furniture constructed either entirely or partially from metal. Metal furniture includes, but is not limited to, components of the following types of products as well as the products themselves: household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture. Metal furniture also includes office and store fixtures, partitions, shelves, lockers, lamps and lighting fixtures, and wastebaskets.

The corresponding Standard Industrial Classification (SIC) codes and North American Industry Classification System (NAICS) codes for these products have been identified. The SIC and NAICS codes were divided into two groups: those that are comprised almost exclusively of metal furniture products (Appendix C, Table C-1), and those that are comprised of metal furniture products as well as other products (Appendix C, Table C-2). Appendix C, Table C-3 lists all the SIC codes from Tables C-1 and C-2 along with their corresponding NAICS codes.[2]

6.2 METHODOLOGY FOR DETERMINING THE MACT FLOOR

For standards established under section 112(d) of the Clean Air Act as amended in 1990 (CAA), the minimum level of control required by the statute is commonly referred to as the "MACT floor." For new sources, emission standards "shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source." For existing sources, the emissions standards must be at least as stringent as either "the average emission limitation achieved by the best performing 12 percent of the existing sources," or "the average emission limitation achieved by the best performing five sources" for categories or subcategories with less than 30 sources. As explained in the following sections, the average of the best performing 12 percent of sources was used in this analysis.

6.2.1 Description of MACT Floor Format

The format selected for the MACT floor analysis (and the proposed standard) is the affected-source-wide organic HAP emissions normalized by the volume of coating solids used (referred to as the emission rate). The emission rate of a source calculated on this basis takes into account emissions from all operations that may emit organic HAP from the metal furniture operations associated with coating application and cleaning (i.e., the affected source). This collection of operations includes cleaning, coating application and curing (including adhesives), mixing and storage, and handling and conveyance of waste materials. The emissions are normalized by the volume of coating solids used within the boundary of the affected source. Thus, the units of the emission rate are kilograms organic HAP emitted per liter coating solids used. Facilities utilize a variety of emission control technologies, and these technologies are reflected in a MACT floor analysis based on an affected-source-wide emission rate. As shown in Table 6-1, the 22 facilities for which the emission rate could be calculated (see Section 6.3.3 for further discussion of these 22 facilities) used a number of different emission control technologies to reduce organic HAP emissions. These technologies included waterbased coatings, high solids coatings, powder coatings, and add-on control devices.

Table 6-1. Products Coated and HAP Emission Control Technology Used By Facilities Included in the MACT Floor Analysis[a]

Facility ID	Products Coated	HAP Emission Control Technology
MFF-03-C	Lockers, racks, storage cabinets	High solids coatings
MFE-06-K	Bedframes, bed rails, rollaway beds, day beds	Waterbased coatings
MFA-08-CP	Chairs	High solids coatings Powder coatings
MFD-01	Office furniture	Waterbased coatings High solids coatings
MFA-07-J	Office furniture	High solids coatings Collect and reuse overspray Automatic painting system
MFE-04	Office and restaurant equipment, copier stands	Waterbased coatings
MFF-01	Framing and struts	Waterbased coatings
MFA-08-CX	Office furniture	High solids coatings Carbon adsorber/oxidizer system
MFE-06-I	Bed frames, bed rails, trundle beds, springs	Waterbased coatings
MFA-08-CF	Computer office furniture	High solids coatings
MFA-08-TX	Office furniture	High solids coatings
MFE-06-J	Bedframes, bed rails, trundle beds	Waterbased coatings
MFF-03-A	Lockers, shelving, shop furniture	High solids coatings Collect and reuse overspray
MFB-02	Residential and commercial lighting fixtures	Waterbased coatings Powder coatings Non-HAP cleaners

Table 6-1. Products Coated and HAP Emission Control Technology Used By Facilities Included in the MACT Floor Analysis[a] (cont.)

Facility ID	Products Coated	HAP Emission Control Technology
MFF-04	Lockers, storage shelves, racks	High solids coatings Waterbased coatings
MFB-03	Commercial and industrial lighting fixtures	High solids coatings
MFE-03-A	Mechanisms for recliners and sleepers, springs, bedframes, institutional beds	Waterbased coatings Powder coatings
MFE-06-F	Office furniture components	Improved cleaning before coating allowed use of coatings with lower solvent content
MFE-06-G	Mechanisms for recliners, rockers, gliders, and sleepers	Waterbased coatings Powder coatings
MFE-03-B	Mechanisms for recliners, rockers, sleepers; baby crib spring units	Waterbased coatings
MFE-06B	Sleeper sofa mechanisms	Dip coating
MFA-07-HAZ	Office furniture	High solids coatings Powder coatings

[a] Source: 1997 and 1998 industry questionnaire responses.

The general industry trend observed through site visits, industry questionnaires, and literature searches is to reduce emissions by reducing the mass of pollutants in coating and cleaning materials rather than by the use of add-on control devices. Therefore, the MACT floor for the standards was based on an emission rate in units of kg HAP/L coating solids, which is a production-based parameter that can be used to compare effectiveness of various pollution prevention and other control technologies. The use of such an emission unit allows an affected source in the metal furniture surface coating industry flexibility in choosing any reasonable means (including but not limited to coating reformulation, conversion to powder coating, solvent elimination, work practices, and capture systems and add-on control devices) to meet the MACT floor level of control. The selected format encourages emission reduction by reformulation but also allows the industry the flexibility to utilize add-on control devices if desired.

Normalizing the organic HAP emissions was necessary to compare emissions from facilities of all sizes, as well as facilities using different coating technologies. Normalizing by the amount of surface area coated was the preferred method because it is the one factor that is consistent across all facilities. However, insufficient surface area data were available for all facilities in the MACT floor analysis. As a substitute for surface area, the volume coating solids used was selected as the normalizing factor. The volume coating solids used is an adequate measure of surface area coated since the average dry film thickness of coatings on most metal furniture products is generally consistent.

6.2.2 Definition of "Average"

As discussed above, the minimum level of control defined under section 112(d) of the CAA is commonly referred to as the MACT floor. The term "average" is not defined in the CAA. In a Federal Register notice published on June 6, 1994 (59 FR 29196), the EPA announced its conclusion that Congress intended "average," as used in section 112(d)(3), to be the mean, median, mode, or some other measure of central tendency. The EPA concluded that it retains substantial discretion, within the statutory framework, to set MACT floors at appropriate levels, and that it construes the word "average" (as used in section 112(d)(3)) to authorize the EPA to use any reasonable method, in a particular factual context, of determining the central tendency of a data set. As discussed in Section 6.3.3, the arithmetic mean was used as the average in this MACT floor analysis.

6.2.3 Meaning of "Best Performing" and "Best Controlled"

For the MACT floor analysis, performance was evaluated in terms of an affected-source-wide estimated emission rate of mass of organic HAP emitted per volume of coating solids used. The "best performing" metal furniture manufacturing facilities were judged to be those with lower emission rates estimated on this basis.

Section 112(d)(3) of the CAA requires that the basis of the MACT floor for new sources be "the emission control achieved in practice by the best controlled similar source." The facility with the lowest estimated affected-source-wide emission rate was considered to be the best controlled source for this analysis.

6.3 COLLECTION AND ANALYSIS OF DATA

6.3.1 Site Visits

Site visits were conducted at nine separate facilities (comprising eight companies) that apply coatings to a variety of relevant products including stadium seating, residential furniture, office furniture, and recliner mechanisms. These facilities ranged from a small plant with less than 100 employees to a major manufacturing facility comprised of multiple buildings employing over 1,000 people.

The purpose of the site visits was to obtain information on facility operations, with particular emphasis on cleaning operations and coating application and curing systems.

6.3.2 Industry Questionnaires

Eight companies were selected[3] to receive the initial metal furniture industry questionnaire in June 1997, in an effort to obtain a broad representation of the metal furniture surface coating industry. The initial questionnaire requested information about the general facility, unit operations (including description, flow diagrams, coating specifications, type of parts and substrate material coated, and waste handling procedures), control measures and applicable regulations, and collocated sources.

Various methods were used to select the recipients of the initial questionnaire, with the desired result being a representative cross-section of the industry. Four companies under SIC code 2522 (office furniture, except wood) received the initial questionnaire as a result of their position as leading manufacturers of office furniture. Through discussions with the National Association of Store Fixture Manufacturers (NASFM), two store fixture manufacturing companies (SIC code 2542) were identified to receive the initial questionnaire. A product search was performed on the Dental Manufacturers of America (DMA) website[4] for manufacturers of dental and laboratory furniture. One dental chair manufacturer (SIC code 3843) and one laboratory furniture manufacturer (SIC code 3821) were chosen from the compiled list to receive the initial questionnaire.

Thirty-three companies received a second, more comprehensive industry questionnaire that was sent in June 1998. The following metal furniture industry segments were surveyed: household, office, and public building furniture; store fixtures, partitions, and shelves; residential and commercial lighting fixtures; laboratory and dental furniture; furniture repair; metal furniture parts and hardware; and miscellaneous metal furniture products. The June 1998 questionnaire generated responses from 75 facilities.

6.3.3 Data Analysis to Determine the MACT Floor

For both the June 1997 and June 1998 questionnaires, responses were received from a total of 85 facilities. Fifty-nine of these facilities were determined to be metal furniture surface coating facilities. For each of these facilities, the questionnaire responses were used to determine the potential to emit HAP and current permit restrictions. Where the potential to emit HAP was above the major source threshold[5] and there were no reported permit restrictions limiting the emissions below the threshold, the facility was identified for the purpose of this analysis as a major source. Those facilities with potential HAP emissions above the major source threshold, but which also reported permit restrictions limiting HAP emissions below the major source threshold, were identified as synthetic minor[6] sources in this analysis. Those facilities with a potential to emit HAP below the major source threshold were identified as area sources. In some instances where data on potential to emit were not available, the determination of major or area source status was made on the basis of technological limitations. For example, a facility that reported actual HAP emissions well below the 10 or 25 tons per year major source threshold, used all powder coatings, and did not report any liquid coating capability was judged technologically limited from emitting HAP at major source levels. Such a facility was considered to be an area source. A total of 49 facilities were assumed to be non-area sources, and data from these facilities were used to develop a database of coating and cleaning material information (questionnaire response database).

6.3.3.1 General Data Set Used. The purpose of the data collection effort was to obtain representative data to characterize the metal furniture surface coating industry, and culminated in a comprehensive database of facility characteristics, material usage, and HAP emissions. The information contained in this database was used to calculate the facility emission rates used in the MACT floor analysis. Data gaps, resulting primarily from incomplete questionnaire responses, limited the number of facilities for which an emission rate could be calculated. Typically, these data gaps consisted of material usage, HAP content, or coating solids content. As a result of these data gaps, facility emission rates could be calculated for only 22 of the 49 facilities in the database.

6.3.3.2. General Procedure for Calculation of the MACT Floor. The calculation of the affected-source-wide organic HAP emissions for each facility was accomplished by assuming that 100 percent of the organic HAP components in all cleaning materials (including surface preparation), thinners, and coatings (including adhesives) are emitted.[7] For the one facility in the MACT floor data set that used an add-on control device, the reported capture and control efficiencies were used to determine actual emissions. These emission values were then normalized for each facility by the volume of coating solids used. Because the format of the MACT floor was an affected-source-wide emission rate based on the materials used, emissions from each individual emission point were not calculated.

The facilities were then ranked from the lowest emission rate to the highest (see Table 6-2). To determine the "average emission limitation achieved by the best performing 12 percent of existing sources" as the MACT floor is defined by section 112 of the CAA, an arithmetic mean was used in this analysis.

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination

Number	Facility ID	Product Description	Facility Status for HAP Emissions	Total HAP Emissions (kg), (1)	Total Coating Solids Volume (L), (1)	Normalized Facility Emission Rate (kg HAP/L coating solids)
Major and synthetic minor facilities that reported all information necessary to calculate the normalized facility emission rate						
1	MFF-03-C	Storage cabinets, lockers, and racks	Major	6,154	65,338	0.094
2	MFE-06-K	Bedframes, bed rails, rollaway beds, and day beds	Major	6,300	63,862	0.099
3	MFA-08-CP	Metal office furniture, chairs	Major	4,186	37,892	0.110
4	MFD-01	Modular furniture, bookcases, chairs, tables, desks, partitions, file cabinets, shelving counters, racks, and lockers	Major	1,481	12,564	0.118
5	MFA-07-J	Metal office furniture	Major	39,476	305,693	0.129
6	MFE-04	Metal furniture parts and hardware, copier stands, office equipment, and other misc. metal products	Major	1,771	12,025	0.147
MACT Floor =	0.116	(AVERAGE OF TOP SIX FACILITIES.)				
7	MFF-01	Bolted framing/strut	Synthetic minor	5,481	33,014	0.166
8	MFA-08-CX	Metal office furniture	Major	69,030	396,862	0.174
9	MFE-06-I	Metal bed frames, bed rails, trundle beds and top springs	Synthetic minor	4,910	27,669	0.177
10	MFA-08-CF	Computer office furniture	Major	13,909	57,640	0.241
11	MFA-08-TX	Metal office furniture, desks, cabinets, storage cabinets, movable walls	Synthetic minor	7,771	28,706	0.271
12	MFF-03-A	Fabricated metal products, lockers, shelving, and shop furniture	Major	52,448	127,866	0.410
13	MFB-02	Residential and commercial lighting fixtures	Major	3,857	8,750	0.441

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination (continued)

Number	Facility ID	Product Description	Facility Status for HAP Emissions	Total HAP Emissions (kg), (1)	Total Coating Solids Volume (L), (1)	Normalized Facility Emission Rate (kg HAP/L coating solids)
14	MFF-04	Lockers, shelving, racks and other miscellaeous metal furniture	Major	118,705	258,522	0.459
15	MFB-03	Commercial, industrial lighting fixtures	Major	22,880	45,717	0.500
16	MFE-03-A	Recliner mechanisms, bed frames and rails, spring units	Major	22,362	40,732	0.549
17	MFE-06-J	Bed frames, bed rails, trundles, and mirror supports	Major	24,713	41,041	0.602
18	MFE-06-F	Office furniture components	Synthetic Minor	11,202	17,656	0.634
19	MFE-06-G	Sofa sleeper beds and recliner mechanisms	Major	41,046	61,360	0.669
20	MFE-03-B	Motion mechanisms, sleepers, baby crib parts, and RV steps	Major	21,061	24,766	0.850
21	MFE-06B	Sleeper sofa mechanisms	Major	13,297	12,319	1.079
22	MFA-07-HAZ	Metal office furniture	Major	182,651	142,751	1.280
Major and synthetic minor facilities that reported incomplete information and for which the emission rate could not be calculated						
23	MFE-06D (6)	Metal bed frames	Synthetic Minor	Insufficient data to calculate	Insufficient data to calculate	
24	MFC-02	Dental chairs/stools	Insufficient	87	Insufficient data to	
25	MFA-08-GA	Metal office furniture	Synthetic minor	Insufficient data to calculate	67,984	
26	MFA-11A	Metal office furniture, wall panels	Major	Insufficient data to calculate	Insufficient data to calculate	

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination (continued)

Number	Facility ID	Product Description	Facility Status for HAP Emissions	Total HAP Emissions (kg), (1)	Total Coating Solids Volume (L), (1)	Normalized Facility Emission Rate (kg HAP/L coating solids)
27	MFA-11B	Metal office furniture, wall panels	Major	Insufficient data to calculate	Insufficient data to calculate	
28	MFE-06E	Metal furniture diecasting	Major	510	Insufficient data to calculate	
29	MFA-08-FP	Metal office furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
30	MFA-09	Metal chairs and tables	Major	Insufficient data to calculate	Insufficient data to calculate	
31	MFE-02	Bedding and furniture springs	Insufficient information to determine	Insufficient data to calculate	Insufficient data to calculate	
32	MFE-06A	Metal bedding components	Major	12,242	Insufficient data to calculate	
33	MFE-06C	Recliner and swivel chair mechanisms	Major	13,738	Insufficient data to calculate	
34	MFA-08-SP	Metal office furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
35	MFA-08-KP	Metal office furniture, movable office panels and partitions	Major	Insufficient data to calculate	Insufficient data to calculate	
36	MFA-08-DP	Metal office furniture	Major	Insufficient data to calculate	Insufficient data to calculate	

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination (continued)

37	MFA-07G	Metal file cabinets, laterals, bookcases, and chairs	Major	Insufficient data to calculate	Insufficient data to calculate	

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination (continued)

Number	Facility ID	Product Description	Facility Status for HAP Emissions	Total HAP Emissions (kg), (1)	Total Coating Solids Volume (L), (1)	Normalized Facility Emission Rate (kg HAP/L coating solids)
38	MFA-07-OS	Metal office furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
39	MFA-08-AL	Metal office furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
40	MFA-08-CA	Metal office furniture, desks, tables, file cabinets, office panels/dividers, chairs and systems furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
41	MFA-10	Household furniture	Major	Insufficient data to calculate	Insufficient data to calculate	
42	MFB-04-LDL	Commercial and residential lighting fixtures	Insufficient information to determine	Insufficient data to calculate	Insufficient data to calculate	
43	MFD-04	Metal office furniture	Insufficient information to determine	6,273	Insufficient data to calculate	
44	MFF-03B	Rack storage units, shelving units, mezzanine	Major	4,019	Insufficient data to calculate	
45	MFF-06-A	Metal store shelves	Insufficient information to determine	Insufficient data to calculate	Insufficient data to calculate	
46	MFF-06-B	Metal store shelves	Insufficient information to determine	Insufficient data to calculate	Insufficient data to calculate	
47	MFF-06-C	Metal store shelves	Insufficient information to determine	Insufficient data to calculate	Insufficient data to calculate	

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Normalized by Coating Solids Usage for the MACT Floor Determination (continued)

Number	Facility ID	Product Description	Facility Status for HAP Emissions	Total HAP Emissions (kg), (1)	Total Coating Solids Volume (L), (1)	Normalized Facility Emission Rate (kg HAP/L coating solids)
48	MFF-05A	Custom metal merchandizing systems	Insufficient information to determine	Insufficient data to calculate	26,652	
49	MFF-05B	Custom metal merchandizing systems	Major	Insufficient data to calculate	25,000	
Area source facilities not included in the MACT floor analysis						
50	MFB-04-COC (2)	Commercial and residential lighting fixtures	Area	0	Insufficient data to calculate	
51	MFA-04 (2)	Store fixture hardware	Area	0	119	0.000
52	MFA-5 (2), (5)	Metal dormitory furniture	Area	117	37,070	0.003
53	MFA-07-ALL (2)	Metal office chairs	Area	0	5,499	0.000
54	MFB-04-LW	Indoor lighting	Area	23	Insufficient data to calculate	
55	MFB-04-HI (2)	Indoor/outdoor lighting fixtures	Area	0	Insufficient data to calculate	
56	MFA-07-GEN (2)	Metal office chairs	Area	0	36,473	0.000
57	MFA-07-WIN (2)	Metal office chairs	Area	0	15,825	0.000
58	MFC-05 (2), (3)	Dental chairs/units	Area	Insufficient data to calculate	2,980	
59	MFC-06 (2), (4)	Dental laboratory furniture	Area	Insufficient data to calculate	2,693	

NOTES:

(1) Facility did not provide organic HAP content or coating solids content information in their questionnaire response.

(2) Emissions from cure volatiles were not considered.

(3) HAP materials used in surface preparation - No quantity of cleaner given.

(4) Xylene used in some cleaning applications - No quantity of cleaner given.

(5) HAP emissions are from cleaning/surface preparation.

(6) Emission rate for this facility cannot be calculated due to possible collocation and data discrepancy issues.

Table 6-2. Facility Cleaning and Coating Application Operations Organic HAP Emissions Norm
Coating Solids Usage for the MACT Floor Determination (continued)

The mode and median were also considered to calculate the average emission limitation. However, both of these indicators of central tendency are more relevant in other situations. The mode concept was not appropriate for this data set because each value in the data set is unique; thus, there was no emission rate that appeared frequently. The median concept is often used when selecting between control technologies rather than for determining an average emission rate. Such an analysis allows the MACT floor level of control to correspond directly to a control technology. Since this MACT floor analysis did not involve selection of a particular control technology, using the median of the data set was not considered an appropriate means of determining average emission limitation. Also, there was no indication that viable control technologies would be excluded by choosing one calculation methodology over the other. Thus, there was no compelling reason to use the mode or the median, and the arithmetic mean was chosen as being the most representative methodology for determining the average of the data set.

The MACT floor for existing sources was thus determined by the arithmetic mean of the affected-source-wide organic HAP emission rates of the top 12 percent of these facilities, which were the top six facilities (12 percent of 49) shown in Table 6-2.[8] This mean value, which is the existing source MACT floor, is 0.12 kg organic HAP/liter coating solids used (1.0 lb/gal). The MACT floor for new and reconstructed sources, based on the best performing source in Table 6-2, is 0.094 kg organic HAP/liter coating solids used (0.78 lb/gal).

6.4 REGULATORY ALTERNATIVES MORE STRINGENT THAN THE MACT FLOOR

Based on information reported in industry questionnaire responses, observations made during site visits, and information obtained through literature and database searches, several organic HAP emission control technologies in use by surface coating industries were identified. This section presents these technologies and evaluates whether each is technically feasible for implementation by the metal furniture surface coating industry. For those technologies determined to be technically feasible, further analysis was performed to determine if they can effectively reduce organic HAP emissions to a level below that represented by the MACT floor technology (low organic HAP content coatings) and to determine the cost of such reduction.

6.4.1 Organic HAP Emission Control Technologies (by coating type)

6.4.1.1 Powder Coatings for Thermal/IR Cure. Powder coatings cured by thermal means (convection heating) or infrared (IR) radiation (or a combination of both) have minimal organic HAP and volatile organic compound (VOC) emissions (cure volatiles), generally result in a smaller waste stream, and have higher durability as compared to traditional liquid coatings.[9] Because these powder coatings are normally applied as dry particles, no solvent-based volatiles are released during the application operation, and cure volatile emissions from the curing operation, if any, are generally much less than the volatile emissions from liquid coating systems. Powder coating application systems used in the metal furniture industry generally consist of a powder delivery system, electrostatic spray gun system, and a spray booth. A powder recovery system may also be included. Since powder coatings applied in the metal furniture surface coating industry contain no solvents, organic HAP and VOC emissions from organic solvents are eliminated during coating preparation as compared to conventional liquid coatings. The use of powder coatings in the metal furniture surface coating industry appears to be increasing. Numerous metal furniture manufacturing facilities have converted existing liquid coating lines to powder or have added powder coating lines.

Powder coating application operations are best suited for long production runs of consistently sized parts without color changes. Whenever there are deviations from this "ideal," powder coating can become a less desirable alternative to conventional liquid coatings. For example, small production runs with multiple color changes would require one of three means of operation. The first is to shut down the powder coating line and perform a complete cleaning of the spray booth and the powder handling and application equipment. This can be a time consuming procedure and may not be feasible in a high production environment. Alternatively, the powder application line could be equipped with multiple spray booths so that one can be cleaned while the others are in production use. This is technically feasible as observed during a site visit to one high production facility, but the equipment cost increases rapidly as the number of booths increase. A third means of operation is to not recycle the powder. However, this results in increased costs for raw materials and increases the amount of waste produced.

While the color selection of powder coatings has increased significantly, it is still not possible to produce the varied surface finishes and colors available from liquid coatings or to apply the coatings at low dried film thicknesses achievable with liquid coatings. Specialty finishes such as antique and crackle, as well as the palette of designer colors offered by some metal furniture manufacturers, may not be adequately duplicated by powder coatings. Some metal furniture manufacturers specialize in products with these unusual finishes. Requiring them to use only powder coatings could eliminate the market niche they supply. However, new powder technologies are being developed to address the limitations that prevented some metal finishers from adopting powder coating systems. These advancements will help reduce the time it takes to change colors under certain conditions[10] and reduce significantly the average film thickness below the present achievable film build of approximately 2 mils.[11]

Even though there are several drawbacks to using these powder coatings, they can be effectively used for many metal furniture coating situations. However, they are not currently demonstrated as a viable control option for all metal furniture products. Therefore, powder coatings are not a technically feasible emission control option and are not evaluated further as a beyond-the-floor option. For information purposes, costs and emission reductions for this technology were estimated and are presented in Appendix D.

6.4.1.2 <u>Powder Coatings for UV Cure</u>. Ultraviolet (UV) curable coatings are used for heat sensitive substrates as they allow much lower curing temperatures (<120°C) than thermal/IR curable coatings which may require curing temperatures of up to 220°C. These UV cured powder coatings, formulated with chemical photoinitiators sensitive to UV light, offer the same quality advantages as thermal/IR cured powder coatings. Upon expose to UV light, these photoinitiators form free radicals that trigger cross-linking (curing) of the resin.[12]

In order to achieve complete curing of UV coatings, the entire coating must be exposed to the UV light source. For metal furniture coating applications, this presents two important problems. First, the vast majority of metal furniture coatings are pigmented. The pigment acts to block the UV light, and this effect intensifies with the dry film thickness of the coating.[13] The shape of the metal furniture components also presents curing problems. Metal furniture products typically have many bends or are box-shaped, thus "shading" some coated areas from exposure to the UV light source. For these reasons, UV coatings have found limited acceptance in the metal furniture surface coating industry and are not evaluated further as a beyond-the-floor option.

6.4.1.3 Low Organic HAP Content Liquid Coatings. A number of liquid coating technologies have been identified through data gathering efforts that contain either very low amounts of organic HAP or contain no organic HAP. These coating technologies fall into two general categories. The first and most common are conventional coatings formulated with solvents that are not organic HAP (but may be VOC), waterbased coatings, and higher coating solids content coatings. Because these coatings do not constitute a different emission control technology than that used by the six facilities in the MACT floor analysis, they were not considered to be a more stringent regulatory alternative. The second category of lower organic HAP content coatings is nonconventional liquid coatings, including liquid formulations of UV curable coatings and autophoretic coatings. These coatings have the potential to reduce organic HAP emissions beyond that achievable by conventional low organic HAP content coatings, so the technical feasibility of this group of coatings was evaluated further.

6.4.1.3.1 UV coatings. UV curable liquid coating formulations have been used for several decades on parts made of wood, composite, and metal. However, they are not being used in the metal furniture industry and the same conclusions reached in the discussion of UV curable powder coatings apply here. Therefore, these coatings were not evaluated further as the basis for a beyond-the-floor option.

6.4.1.3.2 Autophoretic coatings. The autophoretic coating process consists of a series of dip tanks in which the parts to be coated are immersed. This process cleans the parts, then deposits the coating solids on the surface of the parts via a chemical reaction. The coating solids are then heat cured. The only reported use of autophoretic coatings for metal furniture applications was a black coating, which effectively limits its use to parts hidden from view. Because of the limited potential use of autophoretic coatings, they were not evaluated further as the basis for a beyond-the-floor option.

6.4.1.4 Add-on Capture and Control Systems. Organic HAP emissions from coating application and curing operations can be reduced by capturing and directing them to an add-on control device. While add-on control devices are technically feasible options for reducing organic HAP emissions in the metal furniture surface coating industry, information was obtained for only two cases where they are utilized in this industry. In one case, a thermal oxidizer is used, and a thermal oxidizer preceded by a carbon concentrator is used in the other. Other add-on controls applicable to the control of organic HAP emissions include carbon adsorption, absorption, and bioreactors (biofilters).

Capture systems in use by the metal furniture industry are typically limited to the spray booth in which the coatings are applied. While there were no reported uses of permanent total enclosures on the coating application, flash-off, and curing operations (i.e., the coating operation) in our data gathering efforts, such enclosures are used in other coating industries. No technical reasons have been reported that would preclude the use of permanent total enclosures by the metal furniture surface coating industry.

Any add-on control device that will remove or destroy organic HAP emissions from an exhaust stream is technically feasible for emission control of metal furniture surface coating operations. However, the performance of some control devices is affected by variations in the exhaust flow rate and pollutant concentration in the exhaust stream. In the metal furniture surface coating industry, facilities often have a number of spray booths that may or may not be operational at any one time. Also, the actual application of coatings is not continuous. These factors lead to highly variable flow rates and pollutant concentrations. Because of these factors, only thermal oxidizers were considered in this analysis because they have more tolerance to handle such variation. While other control devices may be less expensive on both a capital and annual cost basis, they would not be as likely as thermal oxidizers, given these conditions, to be able to meet a level of control more stringent than the MACT floor level of control on a continuous basis. In order to achieve the level of emission reduction necessary to be considered a more stringent regulatory alternative, complete capture of emissions from the coating operation would be necessary (see Section 6.4.2). Because there were no technical reasons why permanent total enclosures could not be used on metal furniture surface coating operations, permanent total enclosures in conjunction with thermal oxidizers were considered as a potential regulatory alternative to achieve organic HAP emission reductions more stringent than the MACT floor.

6.4.1.5 Organic HAP-free Cleaning Materials. There are two basic types of items cleaned in metal furniture surface coating cleaning operations. The first is cleaning of metal furniture parts and assemblies prior to coating. These cleaning operations typically involve non-HAP acid and caustic solutions. Because cleaning prior to coating usually does not result in HAP emissions, there was no need to perform a beyond-the-floor analysis.

The second type of item cleaned is equipment used in the coating application operation. These items generally consist of spray guns and paint distribution lines. A number of cleaning materials may be used to clean these items, many of which are non-HAP materials. Based on information obtained from site visits, industry questionnaire responses, and literature searches, non-HAP cleaning materials are available and in use by the industry and the general industry trend is to increase usage of non-HAP cleaning materials. Because it is expected that new sources will be more likely to use available emission reduction technology, the cost analysis for new sources included the use of all non-HAP cleaning solvents. This was the basis for determining the emission reduction and for the cost analysis of the beyond-the-floor option.

6.4.2 Emission Reduction of Add-on Capture and Control Systems

Model plants were developed (see Chapter 5) as a tool to estimate the impacts the standards will have on the metal furniture surface coating industry. A model plant does not represent any single actual facility, but rather it represents a range of facilities with similar characteristics that may be impacted by the standards. Each model plant is characterized in terms of facility size and other parameters that affect estimates of emissions, control costs, and secondary environmental impacts. The model plant approach was used to determine whether the technically feasible organic HAP emission control technology (add-on capture and control systems) can achieve an emission rate less than that represented by the existing source MACT floor technology.

Three model plants, distinguished by size as measured by the total volume coating solids (nonvolatiles) used, were developed. Coating data from the industry questionnaire response database were sorted from lowest to highest total volume coating solids used by each facility. The volume coating solids used ranged from a low of about 8,700 liters/yr to a high of nearly 400,000 liters/yr, and fell into three general ranges. These ranges were less than 40,000 liters/yr; 40,000 to 99,999 liters/yr; and greater than 99,999 liters/yr. The model plant sizes of small, medium, and large, respectively, were based on these ranges. The facilities that provided complete responses to the industry questionnaires were divided into three groups based on correspondence to the model plant sizes. Within each of these groups, the average coating and cleaning material usage, coating solids usage, and HAP emissions were calculated. These values were then used to estimate the emission reduction achievable by the add-on capture and control systems.

A facility could choose to capture and control any portion of the emissions from their coating operations.[14] Table 6-3 presents the emission rates achievable by capturing and controlling certain amounts of the emissions from coating operations at each model plant, in conjunction with converting to all non-HAP cleaning materials. Only by capturing and controlling all coating emissions (assuming 100 percent capture of emissions from all coating operations (coating lines) and 98 percent control) can an emission rate be achieved that represents a regulatory alternative more stringent than the existing source MACT floor.

6.4.3 Beyond-the-floor Regulatory Alternative

The existing and new source MACT floors, as well as the proposed rule, are expressed in terms of the total organic HAP emissions from the affected source normalized by the total coating solids used. While it may at first appear that any emission rate below the existing source MACT floor could be considered a more stringent regulatory alternative, the emission control technology used to further reduce emissions below the MACT floor must also be considered. The six facilities on which the existing and new source MACT floors are based use low organic HAP content coatings. Five facilities used low organic HAP content coatings (either higher coating solids content or waterbased coatings) exclusively. The remaining facility used a combination of low organic HAP content coatings and powder coatings. The emission rates achieved for this approach ranged from 0.094 to 0.147 kg HAP/L coating solids (the facility that used both liquid and powder coatings had an emission rate of 0.118 kg HAP/L coating solids).

Each emission control technology may be assumed to represent a range of possible emission rates depending on the specific coatings used, the emission capacity of a coating technology, or the pollutant removal efficiency of an add-on capture and control unit. Because

Table 6-3. Organic HAP Emission Rates Achievable Through the Use of Capture and Control Systems for Existing and New Metal Furniture Surface Coating Model Plants[a]

Model Plant	(A) Total Coating Solids Usage (L/yr)	(B) Total HAP Emissions At MACT Floor Level of Control (kg/yr)	Amount of Organic HAP Emissions Captured and Controlled							
			25 Percent		50 Percent		75 Percent		100 Percent	
			(C) HAP Emissions After Capture and Control[b] (kg/yr)	(D) Emission Rate[c] (kg HAP/L coating solids)	(E) HAP Emissions After Capture and Control[d] (kg/yr)	(F) Emission Rate[e] (kg HAP/L coating solids)	(G) HAP Emissions After Capture and Control[f] (kg/yr)	(H) Emission Rate[g] (kg HAP/L coating solids)	(I) HAP Emissions After Capture and Control[h] (kg/yr)	(J) Emission Rate[i] (kg HAP/L coating solids)
Small	22,000	7,500	5,700	0.259	3,800	0.173	2,000	0.091	200	0.0091
Medium	54,000	19,600	14,800	0.274	10,000	0.185	5,200	0.096	400	0.0074
Large	250,000	92,400	69,800	0.279	47,100	0.188	24,500	0.098	1,800	0.0072

[a] Assumes that existing and new model plants would have the same coating solids usage and organic HAP emissions in the absence of a standard.
[b] C = (B x 25/100) x (100 - 98)/100 + B*(100 - 25)/100
[c] D = C/A
[d] E = (B x 50/100) x (100 - 98)/100 + B*(100 - 50)/100
[e] F = E/A
[f] G = (B x 75/100) x (100 - 98)/100 + B*(100 - 75)/100
[g] H = G/A
[h] I = (B x 100/100) x (100 - 98)/100 + B*(100 - 1000)/100
[i] J = I/A

the beyond-the-floor emission limit cannot be set arbitrarily, an emission rate more stringent than the MACT floor emission rate was established by evaluating the technically feasible emission control technology (i.e., add-on capture and control systems). The analysis provided emission rates for each of the three model plants. While the emission rate was derived by specifically applying add-on capture and control systems, it would not be necessary to use only this technology in actual practice. Any emission control technology that could achieve the emission rates in Table 6-3, Column J, would be acceptable. For example, a facility could use powder coatings or organic HAP-free liquid coatings to achieve these lower emission rates.

6.4.4 Costs of Beyond-the-floor Regulatory Alternative

6.4.4.1 Basis of Cost Estimates. The regulatory alternative cost analysis estimates the additional costs that a source would have to incur above a set baseline to implement the emission controls necessary to achieve the additional emission reduction beyond the MACT floor level of control. The baseline in this analysis is the costs a facility would have incurred to achieve the MACT floor level of control. It was assumed that this baseline is the use of conventional liquid coatings (i.e., a combination of some or all of the following: low organic HAP content solventbased coatings, higher coating solids content solventbased coatings, and waterbased coatings). The costs presented here for the beyond-the-floor regulatory alternative represents the cost of adding a capture and control system to further reduce emissions from the coating operation as well as the cost of organic HAP-free cleaning solvents. Emission capture and control system costs were based on the installation of a permanent total enclosure achieving 100 percent capture and a thermal oxidizer (TO) achieving 98 percent control operating on all of the coating application lines at each model plant. Details of the cost analysis are presented in Appendix E.

6.4.4.1.1 Thermal oxidizers. Insufficient information was available from the questionnaire responses to determine the likely flowrate to the thermal oxidizer. Hence, a flowrate of 200,000 standard cubic feet per minute (scfm) was assumed to be reasonable[15] for the large model plant if all four coating lines were to be totally enclosed and the thermal oxidizer cost was based on this value.

For small and medium model plants, a flowrate of 100,000 scfm to the thermal oxidizer was assumed because emissions from two coating lines would be controlled from each of these model plants.

A regenerative thermal oxidizer (RTO) was chosen for costing purposes because information provided in the EPA OAQPS Control Cost Manual indicates that for flow rates of 50,000 scfm and greater, an RTO should be used.[16] The CO$T-AIR Control Cost Spreadsheets[17] for RTOs, and the Control Cost Manual were used to estimate add-on control costs. The facility parameter inputs to the spreadsheets were based primarily on data from questionnaire responses. Inputs for other parameters such as labor rates and cost of electricity and natural gas, were based on a variety of standard sources.[18,19,20,21] Annual costs included the annualized costs of purchased equipment, assuming an interest rate of 7 percent and equipment life of 10 years for the RTO and 30 years for the permanent total enclosure.

6.4.4.1.2 Permanent total enclosures. The cost of permanent total enclosures was estimated using the Control Cost Manual[22] in conjunction with the EPA's CO$T-AIR Control Cost spreadsheets and spreadsheets obtained from literature sources.[23] The cost associated with permanent total enclosure installations varies with the scope of the project. The construction costs of a permanent total enclosure is dependant upon how much construction is needed to place walls or ceilings, type of doors used, the amount of duct work that has to be modified to meet the EPA Method 204 criteria, how much air conditioning is needed (if any), and the degree to which modifications to the make-up air system are required.[24] The cost of the permanent total enclosure also included information from case studies and cost factors presented in the literature and metal furniture model plant data.[25,26,27] These cost factors were related to total enclosure room volume and the volumetric air flow rate of the room exhaust (see Appendix E).

An average enclosure volume for a single coating line was determined from the questionnaire response information and estimated the cost of a permanent total enclosure that would enclose this volume. This estimate included the cost of installing spot air conditioning (localized air conditioning where needed for operator comfort, rather than air conditioning the entire enclosure). The cost of the air conditioning was based on the volumetric exhaust flowrates for each coating line and cost factors presented in the literature.[28] This single coating line total enclosure cost was then multiplied by the number of coating lines in a model plant to determine the model plant cost.[29] In addition to the recovery of the capital costs of the permanent total enclosure and air conditioning, the annual cost of electricity for the air conditioning was included in the overall annual cost of the permanent total enclosure.

The size of the total enclosure used in this cost analysis was based on enclosing the entire coating application line (application booth, flashoff area, and drying/curing oven). In actual practice, such an extensive total enclosure may not be necessary to meet the emission limit. Depending on the solvents used in a particular coating, the majority of evaporative emissions may occur at the application booth or in the drying oven, resulting in a smaller portion of the evaporative emissions occurring in the flashoff area. Sufficient emission reduction may be achieved simply be constructing a total enclosure around the application booth and routing those emissions along with the curing oven exhaust to the add-on control device. The extent of the total enclosure needed is a case-by-case decision that can be made only after evaluation of the particular circumstances of each facility. In this analysis, the most conservative assumption was used where the entire coating line would be enclosed.

6.4.4.1.3 Organic HAP-free cleaning materials. To determine the cost of converting to organic HAP-free cleaning materials, the average organic HAP-containing cleaning material usage was first determined for each model plant, based on the industry questionnaire responses. One prevalent organic HAP-containing cleaning material (xylene) and one prevalent organic HAP-free cleaning material (isopropyl alcohol) were also selected from the questionnaire responses. The costs of these cleaning materials were $0.40 per liter of xylene and $0.80 per liter of isopropyl alcohol.[30] The cost difference between organic HAP-containing cleaning material and the organic HAP-free cleaning material was then calculated for each model plant based on cleaning material usage. It was assumed that cleaning material usage would remain constant.

6.4.4.2 Cost of Emission Capture and Control Systems. Tables 6-4 and 6-5 present the costs, additional organic HAP emission reduction, and cost per megagram of additional emission reduction for existing and new model plants, respectively, for the regulatory alternative of installing emission capture and control systems on all coating application lines at each model plant. For existing model plants, the cost per megagram of additional emission reduction ranged from $71,000 to $436,000 ($65,000 to $396,000 per ton). On a nationwide basis, the cost was

Table 6-4. Estimated Model Plant Cost per Megagram of Organic HAP Emission Reduction for Existing Metal Furniture Surface Coating Facilities for Installation of Emission Capture and Control Systems

Model Plant	(A) Nationwide Number of Facilities in Each Model Plant Size[a]	(B) Model Plant Coating Solids Usage[b] (L/yr)	(C) Model Plant Annual Costs[c] (1998 $)	(D) Nationwide Annual Costs[c] (1998 MM$)	(E) Model Plant Capital Costs[c] ($)	(F) Baseline Level of Control[d] (kg HAP/L coating solids used)	(G) Regulatory Alternative Level of Control[e] (kg HAP/L coating solids used)	(H) Additional Model Plant Organic HAP Emission Reduction[f] (Mg/yr)	(I) Additional Nationwide Organic HAP Emission Reduction[g] (Mg/yr)	(J) Model Plant Annual Cost per Mg of Additional Organic HAP Emission Reduction[h] ($/Mg)	(K) Nationwide Annual Cost per Mg of Additional Organic HAP Emission Reduction[i] ($/Mg)
Small	314	22,000	1,064,000	334	3,512,000	0.12	0.0091	2.44	766	436,000	436,000
Medium	197	54,000	1,064,000	210	3,512,000	0.12	0.0074	6.08	1,198	175,000	175,000
Large	144	250,000	2,003,000	288	6,344,000	0.12	0.0072	28.2	4,061	71,000	71,000
Total				832					6,025		138,000

[a] Source: Memorandum from Hendricks, D., EC/R Inc., to Serageldin, M., EPS:ESD. August 28, 2001. Nationwide Baseline Characteristics of the Metal Furniture Industry.

[b] Source: Memorandum from Hendricks, D., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 14, 2001. Model Plants for the Metal Furniture Surface Coating Source Category.

[c] Annual and capital costs presented are the additional costs incurred beyond the baseline.
$D = (A \times C)/10^6$

[d] The baseline is the MACT floor level of control. For details on the MACT floor, see: Memorandum from Hendricks, D., and Holmes, K., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 19, 2001. Recommended MACT Floors for Existing and New Major Sources for the Metal Furniture Surface Coating Source Category.

[e] From Table 2, Column J.

[f] $H = (F - G) \times B / 1,000$

[g] $I = A \times H$

[h] $J = C / H$

[i] $K = (D * 10^6) / I$

Table 6-5. Estimated Model Plant Cost per Megagram of Organic HAP Emission Reduction for New Metal Furniture Surface Coating Facilities for Installation of Emission Capture and Control Systems

Model Plant	(A) Nationwide Number of Facilities in Each Model Plant Size[a]	(B) Model Plant Coating Solids Usage[b] (L/yr)	(C) Model Plant Annual Costs[c] (1998 $)	(D) Nationwide Annual Costs[c] (1998 MM$)	(E) Model Plant Capital Costs[c] ($)	(F) Baseline Level of Control[d] (kg HAP/L coating solids used)	(G) Regulatory Alternative Level of Control[e] (kg HAP/L coating solids used)	(H) Additional Model Plant Organic HAP Emission Reduction[f] (Mg/yr)	(I) Additional Nationwide Organic HAP Emission Reduction[g] (Mg/yr)	(J) Model Plant Annual Cost per Mg of Additional Organic HAP Emission Reduction[h] ($/Mg)	(K) Nationwide Annual Cost per Mg of Additional Organic HAP Emission Reduction[i] ($/Mg)
Small	10	22,000	1,064,000	11	3,512,000	0.094	0.0091	1.87	18.7	569,000	569,000
Medium	5	54,000	1,064,000	5	3,512,000	0.094	0.0074	4.68	23.4	227,000	227,000
Large	5	250,000	2,003,000	10	6,344,000	0.094	0.0072	21.7	108.5	92,000	92,000
Total				26					151		172,000

[a] Fifth year after promulgation. Source: Memorandum from Hendricks, D., and Homes, K., EC/R Inc., to Serageldin, M., EPS:ESD. October 1, 2001. New Source MACT Cost Impacts for the Metal Furniture Surface Coating Source Category.

[b] Source: Memorandum from Hendricks, D., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 14, 2001. Model Plants for the Metal Furniture Surface Coating Source Category.

[c] Annual and capital costs presented are the additional costs incurred beyond the baseline.

$D = (A \times C)/10^6$

[d] The baseline is the MACT floor level of control. For details on the MACT floor, see: Memorandum from Hendricks, D., and Holmes, K., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 19, 2001. Recommended MACT Floors for Existing and New Major Sources for the Metal Furniture Surface Coating Source Category.

[e] From Table 2, Column J.

[f] $H = (F - G) \times B / 1{,}000$

[g] $I = A \times H$

[h] $J = C / H$

[i] $K = (D * 10^6) / I$

$138,000 per megagram of additional emission reduction ($125,000 per ton). For new model plants, these costs ranged from $92,000 to $569,000 per megagram of additional organic HAP emission reduction ($84,000 to $517,000 per ton), and $172,000 per megagram ($156,000 per ton) on a nationwide basis.

6.4.5 Conclusions

While the emission capture and control regulatory alternative has been found to be technically feasible for the metal furniture surface coating industry, the estimated cost per megagram of additional organic HAP emission reduction above the baseline is greatly disproportional to the additional emission reduction that would be achieved. This is true whether the analysis is on a model plant or nationwide basis.

6.5 NOTES AND REFERENCES

1. Section 112(a)(1) of the CAA defines a major source as a source that emits or has the potential to emit 9.1 Mg/yr (10 tons/yr) of any HAP or 22.7 Mg/yr (25 tons/yr) of any combination of HAP. A synthetic minor source is a source that has taken federally enforceable permit restrictions to limit HAP emissions below major source thresholds.

2. Detailed information concerning the conversion from SIC to NAICS codes can be obtained from the U.S. Census Bureau. See the U.S. Census Bureau's Internet site at http://www.census.gov/epcd/www/naics.html.

3. At the time the questionnaire recipients were selected, data were available only by SIC code. No facility listings by NAICS code were available.

4. See http://www.dmanews.org.

5. 10 tons/year of any one HAP or 25 tons/year of any combination of HAP.

6. A synthetic minor source is a source that has taken federally enforceable permit restrictions such that their potential to emit HAP does not exceed the 10 tpy/25tpy major source threshold. Without the permit restrictions, a synthetic minor source would be a major source.

7. Some of the data used for these calculations were obtained from material safety data sheets (MSDS). Where the MSDS provided a range rather than a single value, we used the midpoint of the range in the calculations.

8. The average of the top 12 percent of sources in the database was used, not the average of the top five sources, because there are more than 30 sources in the source category, even though complete emissions data were available for less than 30 sources.

9. Ouellette, J. "A Major Player." Chemical Marketing Reporter. October 10, 1994; Volume 24, number 15, pp. SR9-SR10.

10. Guskov, S. "Equipment Techniques for Fast Color Change." Proceedings of Powder Coating 2000. September 26-28, 2000. Indianapolis, Indiana. pp. 77-86.

11. Heflin, D. "Price or Cost That is the Question." Proceedings of Powder Coating 2000. September 26-28, 2000. Indianapolis, Indiana. pp. 39-46.

12. "Manufacturing Process Advantages of UV Curable Coatings," available at http://www.sabreen.com/uv_curable_coatings.html.

13. Note 12.

14. In general terms, the coating operation consists of coating application (the spray booth), flashoff, and drying. One or more of these parts of the coating operation could be enclosed by a permanent total enclosure. For example, a facility could enclose the spray booth and flashoff, but not the drying oven. This would result in two emissions streams from the coating operation: one from the enclosure and one from the drying oven. One or both of these emission streams could be vented to an add-on control device.

15. In fact, a flow rate of 200,000 scfm may be high. The volume of a total enclosure for a large model plant was estimated to be about 180,000 ft^3, which would result in a complete turnover of the enclosure air about every minute. However, the exact size of the enclosure for any given facility is difficult to determine and the 200,000 scfm flow rate was used to be sure that the estimated costs were high enough to represent most situations that may be encountered by industry.

16. U.S. Environmental Protection Agency. OAQPS Control Cost Manual, 5th Edition. EPA-453/B-96001. December 1995. pp. 3-43 to 3-47.

17. U.S. Environmental Protection Agency. CO$T-AIR Control Cost Spreadsheets. Internet address: http://www.epa.gov/ttn/catc/products.html#cccinfo. "Total Annual Cost Spreadsheet

Program - Thermal Incinerators (Total flowrate > 50,000 scfm)." Accessed on March 13, 2000.

18. U.S. Government, Bureau of Labor Statistics. Table 11, Private Industry: Goods-producing and Service-producing Industries. Website address: http://stat.bls.gov/news.release/ecec.ttl.htm. Accessed on December 17, 1999.

19. U.S. Energy Information Administration., Department of Energy, Washington, D.C. World wide web homepage. Table 9.11, Natural Gas Prices. Website address: http://www.eia.doe.gov.emeu/mer/contents.htm. Accessed on March 4, 1999.

20. U.S. Energy Information Administration., Department of Energy, Washington, D.C. World wide web homepage. Table 9.9, Retail Prices of Electricity Sold by Electric Utilities. Website address: http://www.eia.doe.gov.emeu/mer/contents.htm. Accessed on March 4, 1999.

21. U.S. Office of Management and Budget. OMB Circular A-94, "Discount rates to be used in evaluating time-distributed costs and benefits." Revised October 29, 1992. Website address: http://www.whitehouse.gov/WH/EOP/OMB/html/circular.html. Accessed on March 4, 1999.

22. Note 16. pp. 3-20 to 3-64.

23. Lukey, M. "Designing Effective and Safe Permanent Total Enclosures," Air and Waste Management Association. June 1993.

24. Lukey, M. "Permanent Total Enclosures needed in Response to Subpart KK and Changes in Test Procedures." Paper No. 97-TA4B.05. Presented at Air and Waste Management Association 1997 Annual Meeting, Toronto, Ontario, Canada. June 8-13, 1997. p. 4.

25. Note 16.

26. Lukey, M. "Designing Effective and Safe Permanent Total Enclosures." Paper No. 93-TA-33.05. Presented at Air and Waste Management Association 1993 Annual Meeting, Denver, Colorado. June 13-18, 1993.

27. Lukey, M. "Five Design Options for Permanent Total Enclosures." Paper No. VIP-69. Presented at Air and Waste Management Association Specialty Conference "Emerging Solutions to VOC and Air Toxics Control." February 26-28, 1997. San Diego, California.

28. Note 24.

29. The small and medium model plants each have two coating lines. The large model plant has four coating lines.

30. Cleaning material costs were derived from the following sources: Chemical Marketing Reporter, Schnell Publishing Company. http://www.chemexpo.com accessed in August 1999; SouthChem, Durham, NC. July 1999; Worth Chemical, Durham, NC. August 1999.

7.0 ENVIRONMENTAL AND ENERGY IMPACTS

7.1 INTRODUCTION

The purpose of this chapter is to present the estimated environmental and energy impacts related to implementing the maximum achievable control technology (MACT) floor level of control for existing metal furniture surface coating facilities. The impact estimates for both new and existing sources were based on conversion to lower organic hazardous air pollutant (HAP) content coatings (including adhesives) and organic HAP-free cleaning materials.

Existing sources are not expected to achieve compliance with the existing source MACT floor level of control until the beginning of the fourth year after promulgation of a rule. Therefore, there would be no environmental or energy impacts the first three years after promulgation. During each of the fourth and fifth years after promulgation, the nationwide organic HAP emission reduction for existing sources was estimated to be 13,900 Mg/yr (15,300 tons/yr), and the VOC emission reduction was estimated to be 21,700 Mg/yr (23,900 tons/yr). This represents a reduction from the baseline organic HAP emissions of approximately 70 percent, and a reduction from the baseline VOC emissions of approximately 60 percent. There were no energy impacts or other secondary environmental impacts associated with the conversion to reformulated coatings and cleaning materials.

The impacts for new sources were also based on utilization of lower HAP content liquid coatings to achieve the new source MACT floor level of control. For the 5-year period following promulgation of the rule, it was estimated that 20 new sources will be constructed. The organic HAP emission reduction for these new sources was estimated to be 465 Mg/yr (511 tons/yr) in the fifth year after promulgation of a rule implementing the MACT floor level of control. The VOC emission reduction in the fifth year was estimated to be 380 Mg/yr (418 tons/yr). This represents a reduction from the baseline organic HAP emissions of approximately 73 percent. And a reduction of 35 percent from the VOC baseline. There were no energy impacts or other secondary environmental impacts associated with the conversion to reformulated coatings and cleaning materials.

The metal furniture surface coating source category encompasses facilities that apply coatings in the manufacture of metal furniture or component parts of metal furniture. Metal furniture means furniture or components of furniture constructed either entirely or partially from metal. Metal furniture includes, but is not limited to, components of the following types of products as well as the products themselves: household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture. Metal furniture also includes office and store fixtures, partitions, shelves, lockers, lamps and lighting fixtures, and wastebaskets.

The corresponding Standard Industrial Classification (SIC) codes and North American Industry Classification System (NAICS) codes for these products were identified to aid in the estimation of impacts. These SIC and NAICS codes were divided into two groups: those that are comprised almost exclusively of metal furniture products, and those that are related to metal furniture but only partially encompass metal furniture products. Appendix C, Table C-1 lists the product groups and manufacturing SIC codes that are almost exclusively metal furniture. The SIC codes related to metal furniture and their associated relevant products are listed in Appendix C, Table C-2. Appendix C, Table C-3 lists all the SIC codes from Tables C-1 and C-2 along with their corresponding NAICS codes.[1]

7.2 DETERMINATION OF THE NUMBER OF MAJOR SOURCE FACILITIES

As described in Chapter 5, model plants were developed to aid in the estimation of the impacts that meeting the MACT floor level of control (0.12 kg organic HAP/liter coating solids (1.0 lb/gal) for existing sources, 0.094 kg organic HAP/liter coating solids (0.78 lb/gal) for new sources) would have on metal furniture surface coating facilities. The range of the volume of coating solids (nonvolatiles) used by the facilities that responded to the 1997 and 1998 questionnaires was used to set the size of the three model plants. In addition, distinctive parameters were developed for each model plant, including average coating usage. The parameters that describe each of these model plant sizes are shown in Table 7-1. The model plant parameters in conjunction with other industry questionnaire response data were used to estimate the environmental impacts. The use of model plants provides a reasonable estimate of plant-level and nationwide impacts of control options that are representative of the source category without having to simulate the effects of applying control options at all potentially impacted facilities in this source category.

7.2.1. Existing Major Sources

The total nationwide number of existing metal furniture surface coating facilities was estimated using the U.S. Census Bureau's Economic Census.[2] The metal furniture surface coating facilities in the Toxic Release Inventory System (TRIS) database[3] were then used to estimate the percentage of major sources of HAP emissions in each SIC code. Applying the percentage of major sources from the TRIS database to the total number of sources in the Economic Census data gave a nationwide estimate of 655 major sources.

The nationwide number of facilities that fall into the small, medium, and large model plant categories was then determined based on the corresponding size distribution of facilities in the industry questionnaire responses. The small model plant group accounted for 45 percent of the facilities, while the medium and large model plant groups accounted for 32 and 23 percent, respectively. Using these percentages, the 655 estimated nationwide number of existing major source facilities subject to the proposed rule, broken down by model plant size, would be 295 small facilities, 209 medium facilities, and 151 large facilities.

7.2.2. New Major Sources

Information obtained from an industry trade group, questionnaire responses, and industry representatives, were used to estimate the anticipated number of new major sources in the metal furniture surface coating industry. The industry trade group provided an estimate of the percent increase in the sales volume measured in dollars for the United States office furniture market.[4] This information indicated a 3 to 5 percent sales volume increase in terms of current dollars, which included the effect of price increases and inflation. This rate of increase was assumed to

Table 7-1. Model Plant Parameters By Unit Operation[a]

Parameter	Small Model Plant <40,000 liters/yr	Medium Model Plant 40,000 - 99,999 liters/yr	Large Model Plant >99,999 liters/yr
Cleaning Unit Operations			
Cleaning Material Usage (L/yr)	3,000	1,500	90,000
Coating Application Unit Operations			
Liquid Coating Usage (L/yr)	66,000	160,000	440,000
Powder Coating Usage (L/yr)	950	3,600	11,000
Powder Coating Usage[b] (kg/yr)	1,300	5,100	16,000
Coating Solids[c] From Liquid Coatings (L/yr)	21,000	50,000	240,000
Coating Solids From Powder Coatings (L/yr)	950	3,600	11,000
Total Coating Solids (L/yr)	22,000	54,000	250,000
Number of Liquid Coating Lines	2	2	4
Number of Powder Coating Lines	1	1	1

[a] Source: 1997 and 1998 industry questionnaire responses.
[b] An average powder coating density of 1.41 kg/liter was used to convert from liters to kilograms.
[c] Nonvolatiles (film formers).

remain consistent over the 5-year period. After further discussions with the trade group, the actual sales volume increase anticipated for the year 2001, excluding price increases and inflation, was determined to be a 1 to 3 percent increase.[5] This change in sales volume was assumed to be directly related to the number of pieces produced rather than to the same number of more expensively priced pieces, indicating a direct relationship between sales volume and production. Further, it was assumed that production is directly related to coating solids usage. Coating solids usage was taken to be a reliable indicator of overall production level.

The annual model plant coating solids usage values were multiplied by 2 percent, which was the midpoint of the estimated sales volume increase obtained from the industry trade group.[6] The resulting values were the estimated increase in coating solids usage due to the growth in the metal furniture industry. Based on conversations with industry representatives, excess capacity currently exists in the industry, but it is very difficult to quantify because of changing product types and market demands. Additional capacity can also be added at existing facilities. This combination of existing capacity and new capacity at existing facilities was estimated to be large enough to absorb 75 percent of the coating solids usage increase before any new facilities would be required.[7]

Hence, the predicted increase in nationwide annual coating solids usage that will not be absorbed by existing sources was determined to be 35,000 liters for small facilities, 53,000 liters for medium facilities, and 180,000 liters for large facilities (see Table 7-2). Comparing these increases to the individual model plant coating solids usage values, four new facilities would be required each year to handle the increased production (two small, one medium, and one large)[8] (see Table 7-2), or 20 new major source facilities during the 5-year period after promulgation of the rule (see Table 7-3).

7.3 ENVIRONMENTAL IMPACTS FOR EXISTING MAJOR SOURCES

7.3.1 Organic HAP Emission Reduction

To estimate the overall organic HAP emission reduction, the organic HAP emissions from major sources was first estimated assuming that the MACT floor level of control is implemented. The 22 facilities used to estimate the baseline emissions (see Chapter 5) were used

Table 7-2. Estimated Annual Number of New Major Source Facilities for the Metal Furniture Surface Coating Source Category

Model Plant	A Nationwide Number of Major Source Existing Facilities[a]	B Total Coating Solids Usage per Model Plant[b] (liters/yr)	C Nationwide Coating Solids Usage[c] (liters/yr)	D Annual Increase in Coating Solids Usage[d] (%)	E Coating Solids Usage Absorbed By Existing Capacity[e] (%)	F Annual Coating Solids Not Absorbed by Existing Sources Capacity[f] (liters/yr)	G Equivalent Annual Number of New Sources[g]
Small	314	22,000	6,908,000	2	75	35,000	2
Medium	197	54,000	10,638,000	2	75	53,000	1
Large	144	250,000	36,000,000	2	75	180,000	1
Total						268,000	4

[a] Total number of facilities nationwide determined from U.S. Census data. Percent of these that were major sources determined from toxic release inventory system (TRIS) data. Breakdown by model plant size determined by industry questionnaire response data.
[b] Average values from industry questionnaire response data. See Chapter 5.
[c] A x B
[d] Based on industry publication and conversations with industry representatives.
[e] Inferred from conversations with industry representatives.
[f] C x (D/100) x (1-E)
[g] F/B, rounded up to the next highest integer.

Table 7-3. Estimated Number of New Major Source Facilities for Five Years After Promulgation for the Metal Furniture Surface Coating Source Category

Year	Small Model Plant	Medium Model Plant	Large Model Plant	Overall Increase
Year 1	2	1	1	4
Year 2	2	1	1	4
Year 3	2	1	1	4
Year 4	2	1	1	4
Year 5	2	1	1	4
Total	10	5	5	20

in this analysis. These facilities were divided into three groups corresponding to the model plant sizes, and the organic HAP emissions at the MACT floor level of control were calculated for each facility by multiplying the MACT floor emission rate (0.12 kg organic HAP/L coating solids used) by the coating solids usage of the facility. For each of the facilities in a model plant size group, the organic HAP emissions were summed, then scaled up to nationwide levels based on the total number of facilities nationwide corresponding to each model plant size, as was done in Chapter 5 to estimate the baseline emissions. The overall nationwide organic HAP emissions at the MACT floor level of control were then determined by summing the scaled up values for each model plant size group. Finally, the estimated organic HAP emissions at the MACT floor level of control were subtracted from the nationwide baseline organic HAP emissions to determine the nationwide organic HAP emission reduction. The nationwide baseline organic HAP emissions are presented in Table 7-4. The nationwide organic HAP emissions after implementing the MACT floor level of control, as presented in Table 7-5, were estimated to be 6,400 Mg/yr. This represents a reduction of 13,900 Mg/yr (15,300 tons/yr), or approximately 70 percent, from the baseline organic HAP emissions.

7.3.2 VOC Emission Reduction

The emission reduction for the purposes of this environmental impact analysis was estimated using the same general procedure that was used in the previous section for estimating HAP reduction. First, we determined the nationwide VOC baseline emissions by calculating the VOC emission rate in terms of kg VOC/L coating solids for each of the 22 industry questionnaire response facilities. These values were scaled by the nationwide number of facilities corresponding to each model plant size and summed to determine nationwide baseline VOC emissions. The nationwide baseline VOC emissions for existing sources are presented in Table 7-6.

We then calculated the arithmetic average VOC emission rate for those facilities already meeting the MACT floor level of control for organic HAP. This average VOC emission rate was 0.26 kg VOC/L coating solids and was considered a cut-off (or maximum) VOC emission rate. Because these facilities used lower organic HAP content coatings to achieve the MACT

Table 7-4. Nationwide Baseline Organic HAP Emission Estimates for Existing Major Source Metal Furniture Surface Coating Facilities

Facility ID	(A) Reported Organic HAP Emissions[a] (kg/yr)	(B) Corresponding Model Plant Size[b]	(C) Nationwide Baseline Organic HAP Emissions (kg/yr)
MFA-08-CP	4,186	Small	
MFF-01	5,481	Small	
MFA-08-TX	7,771	Small	
MFE-06-I	4,910	Small	
MFE-03-B	21,061	Small	
MFE-06-F	11,202	Small	
MFD-01	1,481	Small	
MFE-06B	13,297	Small	
MFE-04	1,771	Small	
MFB-02	3,857	Small	2,210,000[c]
MFF-03-C	6,154	Medium	
MFE-06-K	6,300	Medium	
MFE-06-G	41,046	Medium	
MFA-08-CF	13,909	Medium	
MFB-03	22,880	Medium	
MFE-06-J	24,713	Medium	
MFE-03-A	22,362	Medium	4,100,000[d]
MFA-08-CX	68,901	Large	
MFA-07-J	39,476	Large	
MFF-04	118,705	Large	
MFA-07-HAZ	182,651	Large	
MFF-03-A	52,448	Large	14,000,000[e]
TOTAL			20,300,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 295/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 209/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 151/5.

Table 7-5. Nationwide Organic HAP Emission Estimates for Major Source Metal Furniture Surface Coating Facilities at the MACT Floor Level of Control

Facility ID	(A) Calculated Organic HAP Emissions at 0.12 kg HAP/L coating solids[a] (kg/yr)	(B) Corresponding Model Plant Size[b]	(C) Nationwide Organic HAP Emissions at 0.12 kg HAP/L coating solids (kg/yr)
MFA-08-CP	4,405	Small	
MFF-01	3,838	Small	
MFA-08-TX	3,337	Small	
MFE-06-I	3,217	Small	
MFE-03-B	2,879	Small	
MFE-06-F	2,053	Small	
MFD-01	1,461	Small	
MFE-06B	1,432	Small	
MFE-04	1,398	Small	
MFB-02	1,017	Small	739,000[c]
MFF-03-C	7,596	Medium	
MFE-06-K	7,425	Medium	
MFE-06-G	7,134	Medium	
MFA-08-CF	6,701	Medium	
MFB-03	5,315	Medium	
MFE-06-J	4,771	Medium	
MFE-03-A	4,735	Medium	1,304,000[d]
MFA-08-CX	46,139	Large	
MFA-07-J	35,540	Large	
MFF-04	30,055	Large	
MFA-07-HAZ	16,596	Large	
MFF-03-A	14,866	Large	4,325,000[e]
TOTAL			6,368,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 295/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 209/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 151/5.

Table 7-6. Nationwide Baseline VOC Emission Estimates for Existing Major Source Metal Furniture Surface Coating Facilities

Facility ID	Reported VOC Emissions[a] (kg/yr)	Corresponding Model Plant Size[b]	Nationwide Baseline VOC Emissions (kg/yr)
MFA-08-CP	12,129	Small	
MFF-01	5,769	Small	
MFA-08-TX	18,377	Small	
MFE-06-I	4,910	Small	
MFE-03-B	26,240	Small	
MFE-06-F	11,202	Small	
MFD-01	3,241	Small	
MFE-06B	65,943	Small	
MFE-04	4,142	Small	
MFB-02	12,453	Small	4,850,000[c]
MFF-03-C	26,887	Medium	
MFE-06-K	6,300	Medium	
MFE-06-G	176,540	Medium	
MFA-08-CF	23,580	Medium	
MFB-03	26,268	Medium	
MFE-06-J	24,713	Medium	
MFE-03-A	51,889	Medium	10,037,000[d]
MFA-08-CX	104,400	Large	
MFA-07-J	132,013	Large	
MFF-04	179,684	Large	
MFA-07-HAZ	220,185	Large	
MFF-03-A	52,448	Large	20,800,000[e]
TOTAL			35,687,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 295/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 209/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 151/5.

floor level of control, it was assumed that their VOC emission rate would be indicative of that achieved by facilities complying with the MACT floor level of control.

The average VOC emission rate was then multiplied by the coating solids usage for each of the 22 facilities to obtain the estimated VOC emissions for each facility after achieving the MACT floor level of control for organic HAP emissions. Similar to the procedure used to estimate the organic HAP emission reduction, the 22 facilities were grouped by model plant size, the VOC emissions were summed for each group, then the emissions were scaled to nationwide levels. The nationwide VOC emissions after implementing the MACT floor level of control for organic HAP emissions, as presented in Table 7-7, were estimated to be 14,000 Mg/yr (15,400 tons/yr). This represents a reduction of 21,700 Mg/yr (23,900 tons/yr), or approximately 60 percent, from the baseline VOC emissions.

7.3.3 Secondary Impacts

Since it was assumed that no add-on control devices would be used to meet the MACT floor level of control for existing sources, there would be no change in emissions of non-HAP pollutants (other than VOC). No information has been obtained to indicate that there would be any change in the amount of waste produced by coating or cleaning operations after conversion to lower organic HAP content coating and organic HAP-free cleaning materials. In addition, no information was obtained that indicated there would be a change in energy consumption or wastewater generation as a result of the conversion.

7.4 ENVIRONMENTAL IMPACTS FOR NEW MAJOR SOURCES

For new sources, the MACT floor level of control was determined to be an emission rate of 0.094 kg organic HAP/L coating solids used (see Chapter 6). The impacts were based on new sources using low organic HAP content coatings (including adhesives) and organic HAP-free cleaning materials.

For the five-year period following promulgation of the rule, it was estimated that 20 new sources will be constructed. This growth was estimated to occur evenly, with four new sources each year. Due to the increasing number of new sources, the impacts increase each year as well. For the fifth year after promulgation of a rule, the estimated organic HAP emission reduction for

Table 7-7. Nationwide VOC Emission Estimates for Existing Major Source Metal Furniture Surface Coating Facilities at the MACT Floor Level of Control

Facility ID	Calculated VOC Emissions at 0.12 kg HAP/L coating solids[a] (kg/yr)	Corresponding Model Plant Size[b]	Nationwide VOC Emissions at 0.12 kg HAP/L coating solids (kg/yr)
MFA-08-CP	9,665	Small	
MFF-01	8,421	Small	
MFA-08-TX	7,322	Small	
MFE-06-I	7,058	Small	
MFE-03-B	6,317	Small	
MFE-06-F	4,504	Small	
MFD-01	3,205	Small	
MFE-06B	3,142	Small	
MFE-04	3,067	Small	
MFB-02	2,232	Small	1,621,000[c]
MFF-03-C	16,666	Medium	
MFE-06-K	16,290	Medium	
MFE-06-G	15,652	Medium	
MFA-08-CF	14,703	Medium	
MFB-03	11,661	Medium	
MFE-06-J	10,469	Medium	
MFE-03-A	10,390	Medium	2,861,000[d]
MFA-08-CX	101,231	Large	
MFA-07-J	77,976	Large	
MFF-04	65,643	Large	
MFA-07-HAZ	36,413	Large	
MFF-03-A	32,616	Large	9,488,000[e]
TOTAL			13,970,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 295/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 209/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 151/5.

the 20 new sources was estimated to be 465 Mg/yr (511 tons/yr), which represents a 73 percent reduction from the baseline organic HAP emissions. The VOC emission reduction for the fifth year was estimated to be 380 Mg/yr (418 tons/yr). This represents a 35 percent reduction from the baseline VOC emissions.

7.4.1. Estimated Nationwide Baseline Organic HAP and VOC Emissions for New Sources

Nationwide baseline organic HAP and VOC emissions for new sources were estimated using the same procedure described in Section 7.3.1. However, the emission for the 22 questionnaire response facilities were scaled by the total number of new sources in the fifth year after promulgation of a rule corresponding to each model plant size, rather than scaling by the number of existing sources as was done in Section 7.3.1. As presented in Tables 7-8 and 7-9, respectively, the nationwide baseline organic HAP emissions for new major sources were estimated to be 635 Mg/yr (698 tons/yr), and the baseline VOC emissions were estimated to be 1,090 Mg/yr (1,200 tons/yr).

7.4.2. Organic HAP Emission Reduction

The organic HAP emission reduction was estimated using the lowest emission rate of the 22 facilities for which emission rates could be calculated. This facility was used as the indicator of the emission rate for new facilities because it was used to establish the new source MACT floor and is the only questionnaire response facility achieving the new source MACT floor emission rate. Therefore, it was assumed that this facility was the best available indicator of what new sources would achieve. Although this facility fell into the medium model plant size classification, it was assumed that this emission rate would apply equally to the small and large model plant size classifications because the same emission control technology (low organic HAP content coatings and organic HAP-free cleaning materials) is expected to be used regardless of facility size.

The organic HAP emission reduction increases each year because four new sources are expected to come on line each year. The values for the fifth year after promulgation are shown in Table 7-10. The fifth year after promulgation was chosen for consistency with the cost impacts (Chapter 8), which are also presented on a fifth-year basis. As presented in Table 7-10, the organic HAP emissions for the 20 new sources in the fifth year after promulgation of a rule were

Table 7-8. Nationwide Baseline Organic HAP Emission Estimates for New Major Source Metal Furniture Surface Coating Facilities

Facility ID	(A) Reported Organic HAP Emissions[a] (kg/yr)	(B) Corresponding Model Plant Size[b]	(C) Nationwide Baseline Organic HAP Emissions (kg/yr)
MFA-08-CP	4,186	Small	
MFF-01	5,481	Small	
MFA-08-TX	7,771	Small	
MFE-06-I	4,910	Small	
MFE-03-B	21,061	Small	
MFE-06-F	11,202	Small	
MFD-01	1,481	Small	
MFE-06B	13,297	Small	
MFE-04	1,771	Small	
MFB-02	3,857	Small	75,000[c]
MFF-03-C	6,154	Medium	
MFE-06-K	6,300	Medium	
MFE-06-G	41,046	Medium	
MFA-08-CF	13,909	Medium	
MFB-03	22,880	Medium	
MFE-06-J	24,713	Medium	
MFE-03-A	22,362	Medium	98,000[d]
MFA-08-CX	68,901	Large	
MFA-07-J	39,476	Large	
MFF-04	118,705	Large	
MFA-07-HAZ	182,651	Large	
MFF-03-A	52,448	Large	462,000[e]
TOTAL			635,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 10/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 5/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 5/5.

Table 7-9. Nationwide Baseline VOC Emission Estimates for New Major Source Metal Furniture Surface Coating Facilities

Facility ID	Reported VOC Emissions[a] (kg/yr)	Corresponding Model Plant Size[b]	Nationwide Baseline VOC Emissions (kg/yr)
MFA-08-CP	12,129	Small	
MFF-01	5,769	Small	
MFA-08-TX	18,377	Small	
MFE-06-I	4,910	Small	
MFE-03-B	26,240	Small	
MFE-06-F	11,202	Small	
MFD-01	3,241	Small	
MFE-06B	65,943	Small	
MFE-04	4,142	Small	
MFB-02	12,453	Small	164,000[c]
MFF-03-C	26,887	Medium	
MFE-06-K	6,300	Medium	
MFE-06-G	176,540	Medium	
MFA-08-CF	23,580	Medium	
MFB-03	26,268	Medium	
MFE-06-J	24,713	Medium	
MFE-03-A	51,889	Medium	240,000[d]
MFA-08-CX	104,400	Large	
MFA-07-J	132,013	Large	
MFF-04	179,684	Large	
MFA-07-HAZ	220,185	Large	
MFF-03-A	52,448	Large	689,000[e]
TOTAL			1,093,000

[a] Source: Industry questionnaire responses.
[b] Small model plant defined as less than 40,000 liters/yr of coating solids usage.
Medium model plant defined as 40,000 to 99,999 liters/yr of coating solids usage.
Large model plant defined as greater than 99,999 liters/yr of coating solids usage.
[c] This value equals the sum of the values in Column A for the small facilities scaled up by a factor of 10/10.
[d] This value equals the sum of the values in Column A for the medium facilities scaled up by a factor of 5/7.
[e] This value equals the sum of the values in Column A for the large facilities scaled up by a factor of 5/5.

Table 7-10. Nationwide Organic HAP and VOC Emissions for the 20 New Sources After the Five-Year Period After Promulgation of a Rule

Model Plant	A Number of New Sources After Five-Year Period After Promulgation[a]	B Total Coating Solids Usage per Model Plant[b] (L/yr)	C Organic HAP Emission Rate After Control[c] (kg/L coating solids)	D VOC Emission Rate After Control[d] (kg/L coating solids)	E Nationwide Organic HAP Emissions After Control[e] (Mg/yr)	F Nationwide VOC Emissions After Control[f] (Mg/yr)
Small	10	22,000	0.094	0.41	21	90
Medium	5	54,000	0.094	0.41	25	110
Large	5	250,000	0.094	0.41	120	510
Total					170	710

[a] From Table 3.
[b] Average values from industry questionnaire response data.
[c] This value represents the new source MACT floor as determined in the following: Memorandum from Hendricks, D., EC/R, to Serageldin, M., EPA:ESD. September 14, 2001. Model Plants for the Metal Furniture Surface Coating Source Category.
[d] This VOC emission rate is from the facility used to establish the new source MACT floor.
[e] E = (A x B x C)/1000
[f] F = (A x B x D)/1000

estimated to be 170 Mg organic HAP/yr. This represents a reduction of 465 Mg/yr (73 percent) from the baseline value shown in Table 7-8.

7.4.3. VOC Emission Reduction.

The VOC emission reduction for new sources was estimated using the same procedure as that for organic HAP emissions. The VOC emission rate was calculated for the facility used to determine the new source MACT floor (that is, the facility with the lowest organic HAP emission rate out of the 22 facilities for which the emission rate could be calculated). This emission rate was 0.41 kg VOC/L coating solids. This emission rate was assumed to be equally applicable to all model plant size classifications because there is no indication that the coatings used by a facility are necessarily affected by the size of the facility.

Table 7-10 presents the VOC emissions for the 20 new sources expected to be in operation in the fifth year after promulgation of a rule. The VOC emissions in the fifth year were estimated to be 710 Mg/yr. This represents a reduction of 380 Mg/yr (35 percent) from the baseline value shown in Table 7-9.

7.6 NOTES AND REFERENCES

1. Detailed information concerning the conversion from SIC to NAICS codes can be obtained from the U.S. Census Bureau. See the U.S. Census Bureau's Internet site at http://www.census.gov/epcd/www/naics.html.

2. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census, Manufacturing: Industry Series (Various Reports). Washington, DC. U.S. Government Printing Office.

3. U.S. Environmental Protection Agency. Toxic Release Inventory System. Internet Address: http://www.epa.gov/enviro/html/tris/tris_query_java.html. Accessed in June 1997.

4. BIFMA International, Statistical Overview (Updated 12/16/99), Obtained from BIFMA website http://bifma.org/statover.html on February 4, 2000.

5. Electronic Mail. Miller, B., BIFMA to Holmes, K., EC/R, Incorporated, "Estimated New Sources." March 24, 2000.

6. Note 4.

7. To a large extent, this assumption was based on the definition of affected source in the proposed regulation. Because the affected source for all practical purposes encompasses all coating and cleaning related activities, it would be possible for many existing sources to add production capacity and, thus, new source requirements would not apply.

8. Example calculation for small facilities:
22,000 L coating solids/yr = annual coating solids usage for a small model plant.
314 = nationwide number of existing facilities corresponding to the small model plant size.
0.02 = 2 percent increase in coating solids usage.
(1-0.75) = amount of coating solids usage not absorbed by existing capacity.

(22,000 L coating solids/yr) x (314 facilities) x (0.02) x (1-0.75) = 35,000 L coating solids/yr.
(35,000 L coating solids/yr) / (22,000 L coating solids/yr) = 1.6, which was rounded to two new facilities per year.

8.0 COST IMPACTS

8.1 INTRODUCTION

The purpose of this chapter is to present the methodology used to estimate the cost impact of implementing the existing source maximum achievable control technology (MACT) floor level of control for the metal furniture surface coating source category. Costs were developed on a model plant basis and were then scaled to nationwide costs.

The costs presented here cover the first 5 years after promulgation of the standards. Because existing sources have 3 years to achieve compliance with the emission limitations, the cost schedule will build up during the first 3 years, reaching a maximum value in the fourth year. The costs then decrease slightly in the fifth year to a value that should reflect the projected cost of compliance from that point on. Nationwide annual costs for existing sources, including monitoring, recordkeeping, and reporting (MR&R) costs, were estimated to be approximately $14.8 million in the fifth year after promulgation of the standards. There were no capital costs for existing sources.

New sources must come into compliance upon startup. Consequently, new sources will be affected by all compliance costs, including monitoring, recordkeeping, and reporting (MR&R) costs, beginning in the first year of their startup. Nationwide annual costs, including monitoring, recordkeeping, and reporting (MR&R) costs, were estimated to be approximately $0.6 million in the fifth year after promulgation of the standards. There were no capital costs for new sources.

8.2 METHODOLOGY FOR ESTIMATING EXISTING SOURCE COSTS

8.2.1 Determination of How Existing Sources Will Comply

There are a variety of compliance methods available to and in use by the industry to meet the MACT floor level of control for organic HAP emissions. These include the use of lower organic HAP content liquid coatings, powder coatings, lower organic HAP content cleaning materials, lower organic HAP content adhesives, and add-on capture and control systems. Various combinations of the available compliance methods may be utilized to achieve the existing source MACT floor level of control. Information obtained from the industry questionnaire responses, industry site visits, trade groups, and industry representatives was analyzed to determine which compliance methods would most likely be used by existing sources and, therefore, which compliance methods to use in this cost analysis.

The cost analysis was based on existing sources using lower organic HAP content liquid coatings (including adhesives), cleaning materials, and thinning solvents to meet the proposed emission limit. Add-on control devices and conversion of a liquid coating operation to powder coating were also considered as a compliance option. While two facilities are known to use add-on control devices, there is no indication that existing sources will use add-on control devices to any significant extent in the future because of the availability of reformulated coating and cleaning materials. While conversion costs on a per liquid coating operation basis were available, the portion of the industry that would convert to powder coating could not be determined. Hence, these costs could not be scaled up to nationwide levels. Thus, conversion to lower organic HAP content coatings and thinners and organic HAP-free cleaning materials was chosen as the basis for estimating the cost impacts for existing sources.

8.2.2 Cost Methodology for Existing Sources

Model plants were developed (see Chapter 5) to aid in the estimation of the impacts the standards will have on the metal furniture surface coating industry. Three model plants (small, medium, and large) were developed. The parameters that describe each of these model plant sizes are presented in Table 8-1.

Table 8-1. Model Plant Parameters By Unit Operation[a]

Parameter	Small Model Plant <40,000 liters/yr	Medium Model Plant 40,000 - 99,999 liters/yr	Large Model Plant >99,999 liters/yr
Cleaning Unit Operations			
Cleaning Material Usage (L/yr)	3,000	1,500	90,000
Coating Application Unit Operations			
Liquid Coating Usage (L/yr)	66,000	160,000	440,000
Powder Coating Usage (L/yr)	950	3,600	11,000
Powder Coating Usage[b] (kg/yr)	1,300	5,100	16,000
Coating Solids[c] From Liquid Coatings (L/yr)	21,000	50,000	240,000
Coating Solids From Powder Coatings (L/yr)	950	3,600	11,000
Total Coating Solids (L/yr)	22,000	54,000	250,000
Number of Liquid Coating Lines	2	2	4
Number of Powder Coating Lines	1	1	1

[a] Source: 1997 and 1998 industry questionnaire responses.

[b] An average powder coating density of 1.41 kg/liter was used to convert from liters to kilograms.

[c] Nonvolatiles (film formers).

Estimated cost impacts were developed for each of the three model plants. To determine nationwide cost impacts, the model plant costs were multiplied by the estimated nationwide number of affected sources corresponding to each model plant size. The total nationwide number of facilities was estimated using the U.S. Census Bureau's Economic Census.[1] The metal furniture surface coating facilities in the Toxic Release Inventory System (TRIS) database[2] were then used to determine the overall percentage of major and area sources of HAP emissions in the industry. Applying the percentage of major sources from the TRIS database to the total number of sources in the Economic Census database gave a nationwide estimate of 655 major sources (see Chapter 5).

Information provided in response to industry questionnaires was used to determine the percentage of existing major source facilities that already meet the emission limit for this rule (9 percent or 59 facilities), and the percentage of existing sources that are synthetic minors (12 percent or 79 facilities). Existing sources that have emission rates equal to or lower than the emission limit would not have to implement controls, but would incur MR&R costs, and synthetic minor sources (based on their potential (capacity) to emit) would not have to implement controls because of the proposed rule. The number of existing sources used for estimating the implementation costs for meeting the emission limit was reduced to account for both of these types of sources, leaving a total of 517 existing sources. However, for annual MR&R costs, sources already meeting the emission limit will have the same MR&R requirements as those sources that are not presently meeting the emission limit, unless they are permitted with a federally enforceable emission limit designating the facility as a synthetic minor source. Therefore, for determining nationwide MR&R costs, the 59 existing sources already meeting the emission limit were included for a total of 576 existing sources.

The nationwide number of facilities that fall into the small, medium, and large model plant categories was then determined based on the corresponding size distribution of facilities in the industry questionnaire responses. The small model plant group accounted for 45 percent of the facilities, while the medium and large model plant groups accounted for 32 and 23 percent, respectively. Using these percentages, the 517 estimated nationwide number of major source facilities subject to the proposed rule, broken down by model plant size, is 233 small facilities, 165 medium facilities, and 119 large facilities.

There are three types of control costs that may be incurred by a facility in the course of complying with the standards: capital, direct, and indirect. Capital costs represent the one-time purchase of equipment. Because the compliance option expected to be used by most facilities to comply with the standards utilizes reformulated raw materials rather than a different coating technology or add-on control devices, we assumed that no capital costs would be incurred. That is, all existing equipment related to the coating application unit operation (spray guns, spray booths, dip tanks, and storage and mixing systems) was assumed to be compatible with lower organic HAP content coatings.[3] Direct costs are incurred on a continuing basis for materials consumed in the manufacturing process, primarily coatings and solvents. Utilities are also included in the direct costs, but are expected to be unchanged since there will be no change in equipment. Indirect costs include overhead, taxes, insurance, and administrative costs, as well as capital recovery costs. Since no capital costs were projected, it was assumed that overhead, taxes, insurance, and administrative costs would not change as a result of converting to lower organic HAP content coatings. For this cost analysis, therefore, only direct costs associated with raw material usage were developed.

In addition to direct costs, affected facilities will incur MR&R costs. Annual MR&R costs were based on the OMB 83-I Supporting Statement, "Information Collection Request for the Metal Furniture Surface Coating Operations Source Category."[4]

8.3 EXISTING SOURCE COST IMPACTS

Table 8-2 presents the nationwide capital and annual (direct and indirect) cost impacts associated with conversion to lower organic HAP content coatings and thinners and organic HAP-free cleaning materials. The costs presented in Table 8-2 represent the costs that would be incurred starting in the fourth year after promulgation of the standards. There would be no such cost in the first three years after promulgation because facilities would not have to be in compliance with the standards until after the third year. Table 8-3 presents the nationwide MR&R costs for existing sources for years 1 through 5 after promulgation of the standards.

Table 8-2. Estimated Capital Costs and Annual Costs (excluding MR&R costs) for All Facilities Converting to All Lower Organic HAP Content Coatings and Organic HAP-free Cleaning Materials -- Metal Furniture Surface Coating Source Category[a]

Unit Operation	Cost per Model Plant			D Number of Facilities Requiring Control	Nationwide Costs		
	A Capital Costs	B Indirect Costs[b]	C Direct Costs[c]		E Capital Costs (AxD)	F Indirect Costs[b] (BxD)	G Direct Costs[c] (CxD)
SMALL MODEL PLANT							
Coating	$0	$0	$0	233	$0	$0	$0
Cleaning	$0	$0	$1,200	233	$0	$0	$279,600
MEDIUM MODEL PLANT							
Coating	$0	$0	$0	165	$0	$0	$0
Cleaning	$0	$0	$600	165	$0	$0	$99,000
LARGE MODEL PLANT							
Coating	$0	$0	$0	119	$0	$0	$0
Cleaning	$0	$0	$36,000	119	$0	$0	$4,284,000
TOTAL NATIONWIDE COSTS					$0	$0	$4,662,600

[a] The costs shown in this table represent the costs incurred during each of years 4 and 5 after promulgation of the standards. No costs associated with coating, cleaning, or adhesives will be incurred during the first 3 years after promulgation. However, we recognize that there will be costs associated with qualifying new cleaners and coatings for product use, but those costs are highly source specific and cannot be quantified here.

[b] Indirect costs include capital recovery, overhead, taxes, insurance, and administrative costs.

[c] Direct costs consists of the operating costs (including utilities), but exclude monitoring, recordkeeping, and reporting costs.

Table 8-3. Nationwide Monitoring, Recordkeeping and Reporting Costs for Existing Sources
Metal Furniture Surface Coating Source Category

A Number of Existing Major Facilities	B MR&R Costs per Facility[a]	C Nationwide MR&R Costs (AxB)
Year One		
576	$1,671	$962,000
Cumulative		$962,000
Year Two		
576	$335	$193,000
Cumulative		$1,155,000
Year Three		
576	$13,124	$7,559,000
Cumulative		$8,714,000
Year Four		
576	$17,701	$10,196,000
Cumulative		$18,910,000
Year Five		
576	$17,555	$10,112,000
Cumulative		$29,022,000

[a] OMB 83-I Supporting Statement, ICR for the Metal Furniture Surface Coating Operations Source Category, September 24, 2001. Represents the annual average cost per facility.

Table 8-4 summarizes the total annual costs (including MR&R costs) on a nationwide basis for the 5-year period after promulgation of the standards. Nationwide annual costs, including MR&R costs, were estimated to be approximately $14.8 million in the fifth year after promulgation.

8.3.1 Coating Operations

The change in direct costs associated with converting from higher organic HAP content liquid coatings to lower organic HAP content liquid coatings is related to two factors. The first is the cost per unit volume of the coatings. From the information collected through initial data gathering efforts, industry questionnaire responses, and industry trade group representatives, there was no indication that a liquid coating with an organic HAP content at or below the MACT floor level of control will cost any more or less than a liquid coating with a higher organic HAP content. The cost of a coating will also vary with the quantity purchased. Usually, the cost goes down as the volume purchased increases. For this analysis, then, it was assumed that there will be no change in the unit volume cost of these liquid coatings, resulting in no change in the annual costs associated with conversion to lower organic HAP content liquid coatings. However, certain costs will be incurred qualifying new liquid coatings for production use, but such costs are highly source specific and cannot be quantified here.

The second factor affecting the direct costs for liquid coating operations is the volume of lower organic HAP content liquid coatings needed to replace an equivalent amount of higher organic HAP content liquid coatings. Based on information provided in the industry questionnaire responses, many of the lower organic HAP content liquid coatings also had a higher coating solids content. This would indicate that overall liquid coating usage may actually decrease as a result of conversion to lower organic HAP content liquid coatings. However, the coating solids content values are variable and are not consistent for all liquid coatings. Due to this variability, whether a reduction in usage would be realized throughout the industry could not be determined. Therefore, it was assumed there would be no decrease in the volume of liquid coating usage in order not to overestimate any possible cost savings.

Table 8-4. Nationwide Annual Cost Summary
Metal Furniture Surface Coating Source Category

Year After Promulgation	A Coating and Cleaning Annual Costs[a]	B Monitoring, Recordkeeping, and Reporting Annual Costs[b]	C Total Annual Cost (A + B)
1	$0	$962,000	$962,000
2	$0	$193,000	$193,000
3	$0	$7,559,000	$7,559,000
4	$4,662,600	$10,196,000	$14,858,600
5	$4,662,600	$10,112,000	$14,774,600
Total			$38,347,200

[a] From Table 8-2.
[b] From Table 8-3.

8.3.2 Cleaning Operations

For costing purposes, one organic HAP cleaning material (xylene) and one organic HAP-free cleaning material (isopropyl alcohol) were selected from the questionnaire responses based on prevalent use by the industry. Xylene represented approximately 34 percent (1,203,000 liters xylene of 3,492,000 liters total cleaning materials) of the reported organic HAP cleaning material usage, and isopropyl alcohol was the most widely reported non-HAP cleaning material in the questionnaire responses. These choices were made solely to illustrate the possible cost differential between the cleaning materials, as isopropyl alcohol is approximately twice the cost of xylene, and is not meant to imply that isopropyl alcohol is an appropriate replacement in all circumstances. This illustrates one of the more conservative choices for a non-HAP alternative cleaning material on the basis of cost, and should adequately account for the maximum cost that may be incurred to make such a change in cleaning materials. However, many types of solvent blends which contain low amounts of organic HAP exist. These may often cost less than the non-HAP materials.

To determine the cost of converting to organic HAP-free cleaning materials, the average organic HAP-containing cleaning material usage was first determined for each model plant, based on the industry questionnaire responses. The costs of these cleaning materials were $0.40 per liter of xylene and $0.80 per liter of isopropyl alcohol.[5] The cost difference between organic HAP-containing cleaning material and the organic HAP-free cleaning material was then calculated for each model plant.

There are no capital costs associated with converting to organic HAP-free cleaning materials. The nationwide annual costs were $279,600, $99,000, and $4,284,000 for small, medium, and large model plants, respectively (see Table 8-2, Column G). It should also be noted that there will be costs associated with qualifying any new cleaning material for production use. These costs, however, are highly source-specific and cannot be quantified here. For example, if a facility switches to a less volatile cleaner, the facility's cleaning emissions will likely be reduced, as well as its usage of cleaning solvents. Significant annual cost savings have been reported in such cases.[6]

8.3.3 Monitoring, Recordkeeping, and Reporting

Each affected source will incur costs for implementing the MR&R requirements of the proposed rule. These costs result primarily from the labor necessary to implement and maintain a system for obtaining information (organic HAP content, coating solids content, density, etc.) on materials used, tracking material usage, performing compliance calculations, and generating reports. The annual MR&R costs presented in Table 8-3 were based on the OMB 83-I Supporting Statement "Information Collection Request for the Metal Furniture Surface Coating Operations Source Category."[7]

In years 1 through 3 it was assumed that existing sources will gradually implement only the MR&R activities necessary to prepare to meet the requirements of the proposed rule. Thus, these costs are relatively low compared to subsequent years. During year 1, only larger existing sources are expected to begin basic activities related to establishing monitoring and recordkeeping systems. However, also occurring in year 1 all existing sources would read the rule to determine whether it applies to them. This one time cost is reflected in the higher MR&R costs for year 1 over year 2. Then, in years 2 and 3, all existing sources are expected to begin setting up monitoring and recordkeeping systems, with an increase in activities in year 3. All existing sources in year 4 will incur the full costs associated with implementing controls to achieve the emission limits, as well as MR&R activities. The MR&R costs decrease slightly in year 5 because certain activities (e.g., initial compliance status notification) are only performed in year four.

8.4 METHODOLOGY FOR ESTIMATING NEW SOURCE COSTS

8.4.1 Number of New Major Sources

Information obtained from an industry trade group, questionnaire responses, and industry representatives was used to estimate the anticipated number of new major sources. The industry trade group provided an estimate of the percent increase in the sales volume measured in dollars for the United States office furniture market.[8] They provided information which indicated a 3 to 5 percent sales volume increase in terms of current dollars, which included the effect of price increases and inflation, as well as increases in sales volume. It was assumed that this rate of increase would be consistent over the 5-year period. After further discussions with the trade group, the actual sales volume increase anticipated for the year 2001, excluding price increases and inflation, was determined to be a 1 to 3 percent increase.[9] This change in sales volume was assumed to be directly related to the number of pieces produced rather than to the same number of more expensively priced pieces. Therefore, it was assumed that a direct relationship exists between sales volume and production. It was further assumed that production is directly related to coating solids (nonvolatiles) usage. Coating solids usage is an accurate indicator of overall production level because the dry film thickness is generally consistent throughout the industry.

As described in Section 8.2.2 for existing sources, model plants were also used to aid in the estimation of the impacts the proposed rule would have on new metal furniture surface coating facilities. As shown in Table 8-1, the annual coating solids usage for small, medium, and large model plants is 22,000, 54,000, and 250,000 liters, respecitively. When multiplied by the estimated nationwide number of existing major source facilities corresponding to each model plant size, the nationwide annual coating solids usage was calculated to be 6,490,000 liters for small facilities, 11,290,000 liters for medium facilities, and 37,750,000 liters for large facilities (Table 8-5, Column C).

The nationwide coating solids usage values were multiplied by 2 percent, which was the midpoint of the estimated sales volume increase obtained from the industry trade group. The resulting values were the estimated increase in coating solids usage due to the growth in the metal furniture industry. Based on conversations with industry representatives, excess capacity currently exists in the industry, but it is very difficult to quantify because of changing product types and market demands. Additional capacity can also be added at existing sources and it was estimated that this combination of existing and new capacity would absorb 75 percent of the coating solids usage increase before any new facilities would be required.[10]

Hence, the predicted increase in nationwide annual coating solids usage that will not be absorbed by existing sources was determined to be 32,450 liters for small facilities, 56,450 liters for medium facilities, and 188,800 liters for large facilities (Table 8-5, Column F). Comparing these increases to the individual model plant coating solids usage values, four new facilities would be required each year to handle the increased production (two small, one medium, and one

Table 8-5. Estimated Annual Number of New Major Source Facilities for the Metal Furniture Surface Coating Source Category

Model Plant	A Nationwide Number of Major Source Existing Facilities[a]	B Total Coating Solids Usage per Model Plant[b] (liters/yr)	C Nationwide Coating Solids Usage[c] (liters/yr)	D Annual Increase in Coating Solids Usage[d] (%)	E Coating Solids Usage Absorbed By Existing Capacity[e] (%)	F Annual Coating Solids Not Absorbed by Existing Sources Capacity[f] (liters/yr)	G Equivalent Annual Number of New Sources[g]
Small	295	22,000	6,490,000	2	75	32,450	2
Medium	209	54,000	11,290,000	2	75	56,450	1
Large	151	250,000	37,750,000	2	75	188,800	1
Total						277,700	4

[a] Total number of facilities nationwide determined from U.S. Census data. Percent of these that were major sources determined from toxic release inventory system (TRIS) data. Breakdown by model plant size determined by industry questionnaire response data.
[b] Average values from industry questionnaire response data.
[c] A x B
[d] Based on industry publication and conversations with industry representatives.
[e] Inferred from conversations with industry representatives.
[f] C x (D/100) x (1-E/100)
[g] F/B

large)[11] (see Table 8-5), or 20 new major source facilities during the 5-year period after promulgation of the rule (see Table 8-6).

Table 8-6. Estimated Number of New Major Source Facilities for Five Years After Promulgation for the Metal Furniture Surface Coating Source Category

Year	Small Model Plant	Medium Model Plant	Large Model Plant	Overall Increase
Year 1	2	1	1	4
Year 2	2	1	1	4
Year 3	2	1	1	4
Year 4	2	1	1	4
Year 5	2	1	1	4
Total	10	5	5	20

8.4.2 Determination of How New Sources Will Comply

As described in Section 8.2.1, there are a variety of compliance methods available to and in use by the industry to meet the MACT floor level of control for organic HAP emissions. Because the emission limit for new sources in the proposed rule is not significantly more stringent than the emission limit for existing sources, it was assumed that the same emission control technology could be used by new sources to meet the emission limit. That is, new sources are expected to reduce emissions using lower organic HAP content liquid coatings (including adhesives), cleaning materials, and thinning solvents. In addition, it was assumed that the coatings used will have a higher coating solids content, which was based on information derived from the industry questionnaire response database.

8.4.3 Cost Methodology for New Sources

As discussed in the existing source cost analysis in Section 8.3, model plants were used to facilitate the estimation of impacts of the proposed rule on the metal furniture surface coating industry.

These model plants were also used to estimate the new source cost impacts, using the number of new facilities corresponding to each model plant size to scale up individual model plant costs to nationwide levels.

The new source cost analysis reflects the costs that are a direct result of having to achieve the new source MACT floor level of control. This requires determining the costs that would have been incurred in the absence of this requirement. It was assumed that a new source would use conventional liquid coatings and organic HAP thinners and cleaning solvents if it did not have to comply with an emission limit or rule. Thus, the incremental cost of achieving the new source MACT floor level of control would be the difference in cost between these materials and the cost of lower organic HAP content coatings and thinners and organic HAP-free cleaning materials.

In addition to direct costs, new affected sources will incur MR&R costs. Annual MR&R costs were based on the OMB 83-I Supporting Statement, “Information Collection Request for the Metal Furniture Surface Coating Operations Source Category.”[12]

8.5 NEW SOURCE COST IMPACTS

Table 8-7 presents the nationwide capital and annual (direct and indirect) cost impacts associated with the use of lower organic HAP content coatings and thinners and organic HAP-free cleaning materials. The costs presented in Table 8-7 represent the costs that would be incurred by the four new sources in the first year after promulgation of the standards because new sources would have to comply upon startup. In the second year after promulgation, an additional four new sources would come on line, and annual costs would double from the that shown in Table 8-7. Costs would increase similarly in each of the five years after promulgation as four new sources come on line each year. Table 8-8 presents the nationwide MR&R costs for new sources for years 1 through 5 after promulgation of the standards. Table 8-9 summarizes the total annual costs (including MR&R costs) on a nationwide basis for the 5-year period. Nationwide annual costs, including MR&R costs, were estimated to be $0.6 million in the fifth year after promulgation.

Table 8-7. Estimated Capital Costs and Annual Costs (excluding MR&R costs) for New Facilities Using Lower Organic HAP Content Coatings and Organic HAP-free Cleaning Materials -- Metal Furniture Surface Coating Source Category[a]

Unit Operation	Cost per Model Plant			D Annual Number of Facilities Requiring Control	Nationwide Costs		
	A Capital Costs	B Indirect Costs[b]	C Direct Costs[c]		E Capital Costs (AxD)	F Indirect Costs[b] (BxD)	G Direct Costs[c] (CxD)
SMALL MODEL PLANT							
Coating	$0	$0	$0	2	$0	$0	$0
Cleaning	$0	$0	$1,200	2	$0	$0	$2,400
MEDIUM MODEL PLANT							
Coating	$0	$0	$0	1	$0	$0	$0
Cleaning	$0	$0	$600	1	$0	$0	$600
LARGE MODEL PLANT							
Coating	$0	$0	$0	1	$0	$0	$0
Cleaning	$0	$0	$36,000	1	$0	$0	$36,000
TOTAL NATIONWIDE COSTS					$0	$0	$39,000

[a] The cost shown in this table represent the first year after promulgation. The number of new sources coming on line in each subsequent year is the same as shown in this table. Thus, the total costs in the second year after promulgation would be twice that shown in this table, cost in the third year would be three times that shown in this table, etc. See Column A in Table 8-9.

[b] Indirect costs include capital recovery, overhead, taxes, insurance, and administrative costs.

[c] Direct costs consists of the operating costs (including utilities), but exclude monitoring, recordkeeping, and reporting costs.

Table 8-8. Nationwide Monitoring, Recordkeeping, and Reporting Costs for New Sources Metal Furniture Surface Coating Source Category

A Number of New Major Sources	B MR&R Costs per Facility[a]	C Nationwide MR&R Costs (AxB)
Year One		
4	$33,750	$135,000
Cumulative		$135,000
Year Two		
8	$26,750	$214,000
Cumulative		$349,000
Year Three		
12	$24,400	$293,000
Cumulative		$642,000
Year Four		
16	$21,060	$337,000
Cumulative		$979,000
Year Five		
20	$20,350	$407,000
Cumulative		$1,386,000

[a] OMB 83-I Supporting Statement, ICR for the Metal Furniture Surface Coating Operations Source Category, September 24, 2001. Represents the annual average cost per facility.

Table 8-9. Nationwide Annual Cost Summary for New Sources
Metal Furniture Surface Coating Source Category

Year After Promulgation	A Coating and Cleaning Annual Costs[a]	B Monitoring, Recordkeeping, and Reporting Annual Costs[b]	C Total Annual Cost (A + B)
1	$39,000	$135,000	$174,000
2	$78,000	$214,000	$292,000
3	$117,000	$293,000	$410,000
4	$156,000	$337,000	$493,000
5	$195,000	$407,000	$602,000
Total			$1,971,000

[a] Calculations for the first year are shown in Table 3. Because we estimated that the same number of new sources will come on line each year, these costs are additive in each subsequent year.
[b] From Table 8-8.

8.5.1 Coating Operations.

Similar to the cost analysis for existing sources, it was assumed that there will be no change in the unit volume cost of using lower organic HAP content coatings as compared to higher organic HAP content coatings (see Section 8.3.1). Thus, no change in the annual costs associated with conversion to lower organic HAP content coatings is expected. However, certain costs will be incurred qualifying new liquid coatings for production use, but such costs are highly source specific and cannot be quantified here.

8.5.2 Cleaning Operations.

The new source cost analysis for cleaning materials followed the procedure detailed in Section 8.3.2 for existing sources. There were no capital costs associated with converting to organic HAP-free cleaning materials. The annual costs for the four new facilities coming on line each year after promulgation were estimated to be $2,400, $600, and $36,000 for small, medium, and large model plants, respectively (see Table 8-7, Column G). It should also be noted that there will be costs associated with qualifying any new cleaning material for production use. These costs, however, are highly source-specific and cannot be quantified here. For example, if a facility switches to a less volatile cleaner, the facility's cleaning emissions will likely be reduced, as well as its usage of cleaning solvents. Significant annual cost savings have been reported in such cases.[13]

8.5.3 Monitoring, Recordkeeping, and Reporting.

Each new affected facility will incur costs for implementing the MR&R requirements of the standard. These costs result primarily from the labor necessary to implement and maintain a system for obtaining information (organic HAP content, coating solids content, density, etc.) on materials used, tracking material usage, performing compliance calculations, and generating reports. The annual MR&R costs presented in Table 8-8 were based on the OMB 83-I Supporting Statement "Information Collection Request for the Metal Furniture Surface Coating Operations Source Category."[14]

8.6 NOTES AND REFERENCES

1. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census, Manufacturing: Industry Series (Various Reports). Washington, DC. U.S. Government Printing Office.

2. U.S. Environmental Protection Agency. Toxic Release Inventory System. Internet Address: http://www.epa.gov/enviro/html/tris/tris_query_java.html. Accessed in June 1997.

3. Based on the industry questionnaire responses, the facilities that spray apply liquid coatings all used the same general types of application equipment (nearly all facilities reported some form of electrostatic spray application equipment and a few reported that the use of high volume low pressure (HVLP) spraying equipment). From this, the conclusion was made that low organic HAP content coatings reflect a change in the choice of solvent used in the coating formulation, not a significant departure in the nature of the coating itself. The solvent, whether HAP or non-HAP, is chosen for compatibility with the resin system and to impart characteristics, such as viscosity, that allow the coating to be applied as desired. The choice of solvent, thus, typically does not affect the application method.

4. OMB 83-I Supporting Statement, "ICR for the Metal Furniture Surface Coating Operations Source Category." ICR Number 1952-01. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. September 24, 2001.

5. Cleaning material costs were derived from the following sources:
   Chemical Marketing Reporter, Schnell Publishing Company. Web site address: http://www.chemexpo.com accessed in August 1999.
   SouthChem, Durham, NC. July 1999.
   Worth Chemical, Durham, NC. August 1999.

6. Alternative Control Techniques Document – Industrial Cleaning Solvents. EPA-453/R-94-015. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. February 1994. pp. 5-8 and 5-9.

7. Note 4.

8. BIFMA International, Statistical Overview (Updated 12/16/99), Obtained from BIFMA website http://bifma.org/statover.html on February 4, 2000.

9. Electronic Mail. Miller, B., BIFMA to Holmes, K., EC/R, Incorporated, "Estimated New Sources." March 24, 2000.

10. To a large extent, this assumption was based on the definition of affected source in the proposed regulation. Because the affected source for all practical purposes encompasses all coating and cleaning related operations, it would be possible for many existing sources to add production capacity and, thus, new source requirements would not apply.

11. Example calculation for small facilities:
22,000 L coating solids/yr = annual coating solids usage for a small model plant.
295 = nationwide number of existing facilities corresponding to the small model plant size.
0.02 = 2 percent increase in coating solids usage.
(1-0.75) = amount of coating solids usage not absorbed by existing capacity.

(22,000 L coating solids/yr) x (295 facilities) x (0.02) x (1-0.75) = 32,450 L coating solids/yr.
(32,450 L coating solids/yr) / (22,000 L coating solids/yr) = 1.5, which was rounded to 2 new facilities per year.

12. Note 4.

13. Note 6.

14. Note 4.

9.0 ECONOMIC IMPACT AND SMALL BUSINESS ANALYSIS

9.1 INTRODUCTION

This chapter evaluates the economic impacts of pollution control requirements on metal furniture surface coating operations. These requirements are designed to reduce emissions of hazardous air pollutants (HAP) into the atmosphere. The Clean Air Act's purpose is to protect and enhance the quality of the nation's air resources (Section 101(b)). Section 112 of the Clean Air Act Amendments of 1990 establishes the authority to set national emission standards for HAP. The emissions of HAP from metal furniture manufacturing originates from the cleaning and coating of these products.

To reduce emissions of HAP, the EPA establishes maximum achievable control technology (MACT) standards. The term "MACT floor" refers to the minimum control technology on which MACT standards can be based. For existing major sources, the MACT floor is the average emissions limitation achieved by the best performing 12 percent of sources (if there are 30 or more sources in the category or subcategory). The MACT can be more stringent than the floor, considering costs, non-air quality health and environmental impacts, and energy requirements. The estimated costs for individual plants to comply with the MACT standards are inputs into the economic impact analysis presented in this report.

9.2 ECONOMIC IMPACTS

The MACT standards for metal furniture surface coating facilities require these producers to reduce the level of HAP in their coatings and solvents to meet the levels specified by the floor. The costs of meeting the MACT standards will vary across facilities depending upon their physical characteristics and current usage of coatings and solvents. These regulatory costs will have financial implications for the affected producers, and broader implications as these effects are transmitted through market relationships to other producers and consumers. These potential economic impacts are the subject of this section.

Inputs to the economic analysis include:

1. Baseline characterization of metal furniture industry
2. Baseline market data as projected from industry and secondary sources
3. Compliance cost estimates for industry segments (through model plants) to meet the MACT floor standards.

The EPA has estimated the nationwide compliance costs of this regulation on existing sources to be $14.77 million in the fifth year after promulgation.

Metal furniture production is an assembly-line process in which components are cut, assembled, and coated. The common structural materials used in production are steel and aluminum; however, there has been a recent trend toward the use of plastics for certain components. Production of metal furniture involves coating operations that emit HAP through use of coatings containing organic solvents. Coatings are applied to the metal surfaces to protect them from wear and corrosion. The coatings possess varying characteristics which make them suitable for different applications.

Households, businesses, and institutions purchase and use metal furniture and related products. The Standard Industrial Classification (SIC) codes of the industries that manufacture the various products covered under this source category are provided in Appendix C, Table. For the purposes on this analysis, the metal furniture industry segments are defined as:

1. **Metal furniture** classified by SIC codes 2514, 2522, and 2531 and include household metal furniture, office metal furniture, and public building metal furniture
2. **Metal fixtures** classified by SIC 2542, 3645, 3646, and 2599 and includes cabinets, counters, display cases, residential lighting fixtures, commercial and industrial lighting fixtures, and institutional lighting fixtures

3. **Fabricated metal products** covered by SIC codes 3429, 3469, and 3495 and includes furniture hardware, wastebaskets, stamped metal, and furniture springs

4. **Dental and laboratory metal furniture and apparatus** covered by SIC codes 3821 and 3843 and include dental cabinets and chairs; and laboratory furniture, benches, tables, and cabinets.

Appendix C, Table C-3 lists the corresponding North American Industry Classification System (NAICS) codes.

The following subsections address the economic impacts of the regulation on the individual industry segments and the product markets served by those facilities within each segment.

9.2.1 Market Impacts

In conducting an economic impact analysis, the EPA typically models the responses by producers and markets to the imposition of the proposed regulation. The alternatives available to producers in response to the regulation and the context of these choices are important in determining the economic and financial impacts. Economic theory predicts that producers will take actions to minimize their share of the regulatory costs. Producers decide whether to continue production and, if so, determine the optimal level consistent with market signals. These choices and market feedback allow them to pass costs forward to the consumers of their end-products or services and/or to pass costs backward to the suppliers of production inputs.

Table 9-1 presents total annual compliance costs as a share of the value of shipments for the major industry segments affected by this regulation. These estimates are also provided for each SIC code within the metal furniture industry segment.

Table 9-1 shows that compliance costs are an extremely small share of the value of shipments. Within the metal furniture industry segment, costs range from 0.02 to 0.07 percent of the value of shipments, indicating that the costs of meeting this regulation are not deemed significant. If the metal furniture producers were to partially or fully absorb the costs of complying with this rule, market prices would either increase by less than shown in Table 9-1 or not at all. Because of the product diversity within these SIC codes, the government and industry

Table 9-1. Effect of Compliance Costs on Metal Furniture Producers by Industry Segment: 1997

Industry Segment	Value of Shipments ($\$10^6$/yr)[a]	Total Compliance Costs ($\$10^6$/yr)	Cost Share[b] (%)
Metal Furniture	$11,791	$4.4	0.04
Household (SIC 2514)	$2,275	$1.7	0.07
Office (SIC 2522)	$8,001	$1.9	0.02
Institutional (SIC 2531)	$1,515	$0.9	0.06
Metal Fixtures (SICs 2542, 3645, 3646, 2599)	$10,334	$7.5	0.07
Fabricated Metal Products (SICs 3429, 3469, 3495)	$5,150	$1.8	0.04
Dental and Laboratory (SICs 3821, 3843)	$4,686	$1.1	0.02
Total, all industry segments	$31,961	$14.8	0.05

[a]Total compliance cost are representative of the expected costs faced by affected facilities within the listed SIC codes.
[b]Relative cost shares computed as the total compliance costs divided by the value of shipments.

data do not provide the requisite production and/or price data upon which to base the economic modeling. In lieu of these data, the EPA has employed a 1997 baseline characterization for each industry segment where price is normalized to $1 so that the "value of shipments" proxies the production quantity. The cost shares across the industry segments are then used as the "shifters" of the market supply curve in a partial equilibrium model.

Based on the EPA's partial equilibrium modeling, as shown in Table 9-2, the projected change in market price and output is minimal as a result of the proposed MACT standard on existing sources. The market price and output impacts are less than 0.1 percent across all industry segments. The metal household furniture and the metal fixtures industry segments are projected to incur the largest impacts of 0.04 percent.

Table 9-2. Market Impacts on Metal Furniture Producers by Industry Segment: 1997

Industry Segment	Cost Share of Sales (%)	Market Impacts[a] (%)	
		Price	Output
Metal Furniture	0.04	0.02	-0.02
Household (SIC 2514)	0.07	0.04	-0.04
Office (SIC 2522)	0.02	0.01	-0.01
Institutional (SIC 2531)	0.06	0.03	-0.03
Metal Fixtures (SICs 2542, 3645, 3646, 2599)	0.07	0.04	-0.04
Fabricated Metal Products (SICs 3429, 3469, 3495)	0.04	0.02	-0.02
Dental and Laboratory (SICs 3821, 3843)	0.02	0.01	-0.01
Total, all industry segments	0.05	0.02	-0.02

[a] Percent change in market price and output result from the EPA's partial equilibrium model with unitary market supply and demand elasticities. As a result, the predicted percent change for price and output will be the same.

9.2.2 Social Costs and Their Distribution

The value of a regulatory action is traditionally measured by the change in economic welfare that it generates. Welfare impacts, or the social costs required to achieve the environmental improvements, stem from the regulation's effect on market outcomes and will extend to the many consumers and producers of metal furniture and related products. For this analysis, based on applied welfare economics principles, social costs are measured as the sum of the regulation induced changes in consumer and producer welfare (otherwise known as 'surplus'). Consumers experience reductions in their surplus because of increased market prices and reduced levels of consumption. Producers may experience either increases or decreases in their surplus (i.e., profits) as a result of increased market prices and changes in production levels and compliance costs. However, it is important to emphasize that these surplus measures do not include benefits that occur outside the market, that is, the value of reduced levels of air pollution with the regulation.

The national estimate of compliance costs is often used as an approximation of the social cost of the rule. Under the MACT floor, the engineering analysis estimated annual costs for existing facilities to be $14.77 million. However, this estimate does not account for behavioral responses by producers or consumers to the imposition of the regulation (e.g., shifting costs to other economic agents, closing product lines or facilities). Accounting for these responses results in a social cost estimate that differs from the engineering estimate and provides insights on how the regulatory burden is distributed across society (i.e., the many consumers and producers of metal furniture and related products). The economic welfare impacts of the regulation on producers and consumers can be considered under three different scenarios:

1. Full-cost absorption by producers
2. Full-cost pass-through to consumers
3. Partial-cost pass-through to consumers.

Full-cost absorption lacks any accounting for behavioral responses to regulation, and in this scenario producers bear the full compliance costs of the regulation. The other scenarios account for behavioral responses to regulation both by consumers and producers. Full-cost pass-through refers to a situation where producers are able to pass the social costs of the regulation fully onto consumers. Alternatively, partial-cost pass-through refers to a situation where regulatory costs are borne both by consumers and producers.

9.2.2.1 Full-Cost Absorption. Under full-cost absorption, producers have no behavioral response to the implementation of a regulation. The full regulatory compliance costs are incurred by affected facilities, whose owners experience a loss in profits equal to that amount, i.e., $14.77 million. Since output is unchanged, market prices remain the same under the full-cost absorption scenario and consumers continue to demand the same quantity. As shown in Table 9-3, the welfare change is composed entirely by a loss in producer surplus with no change (by assumption) in consumer surplus in this case.

Table 9-3. Economic Welfare Impacts of Metal Furniture MACT on Producers, Consumers, and Society

Stakeholders	Welfare Change		
	Full-Cost Absorption	Partial-Cost Pass-Through (Fig. 9-2)	Full-Cost Pass-Through (Fig. 9-1)
Producers	- $14.77 million	- $7.38 million	0
Consumers	$0	- $7.38 million	- $14.77 million
Society	- $14.77 million	- $14.77 million	- $14.77 million

Note: Totals may not add due to rounding.

9.2.2.2 Full-Cost Pass-Through. Under full-cost pass-through, producers can pass the entire burden of the regulation onto consumers of metal furniture and related products. In Figure 9-1, the demand of consumers is represented by the downwards-sloping curve D and the original supply curve of producers is represented by S_0. Implementing the regulation results in a shift in the supply curve from S_0 to S_1. This leads to an increase in the market price from P_0 to P_1 to incorporate the compliance costs. This rise in price leads consumers to purchase a smaller quantity, Q_1, as can be seen by examining the market demand curve (the new equilibrium point c). As shown in Figure 9-1, the loss in consumer surplus here is the area P_0acP_1, which is less than the full compliance costs, i.e., area P_0abP_1, because consumers reduce their consumption from Q_0 to Q_1. Thus, as shown in Table 9-3, the welfare change is composed entirely by a loss in consumer surplus of $14.77 million with no change in producer surplus.

9.2.2.3 Partial-Cost Pass-Through. The economic welfare effects of a partial cost pass through can be examined by referring to Figure 9-2. In this case, both consumers and producers experience a change in welfare. Once again market demand is represented by a standard downward-sloping curve. The supply curve is represented as an upward-sloping curve; equilibrium is determined by the intersection. The effect of the regulation is to shift the supply curve from S_0 to S_1. This will lead to a change in both consumer and producer surplus. The loss

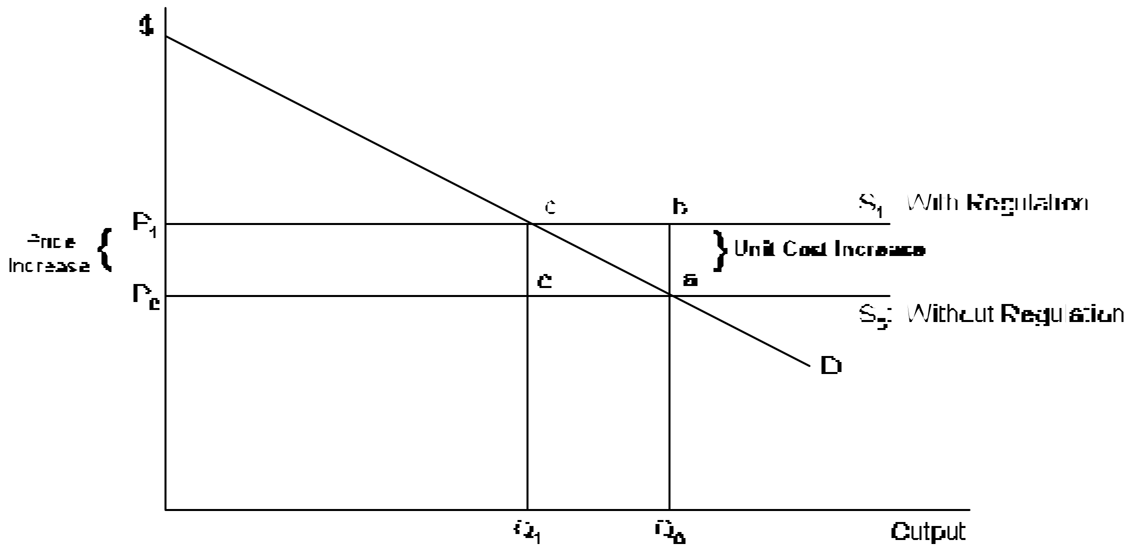

Figure 9-1. Full-Cost Pass-Through of Regulatory Costs

in consumer surplus is represented by the area P_0bcP_1. This loss in surplus occurs because consumers

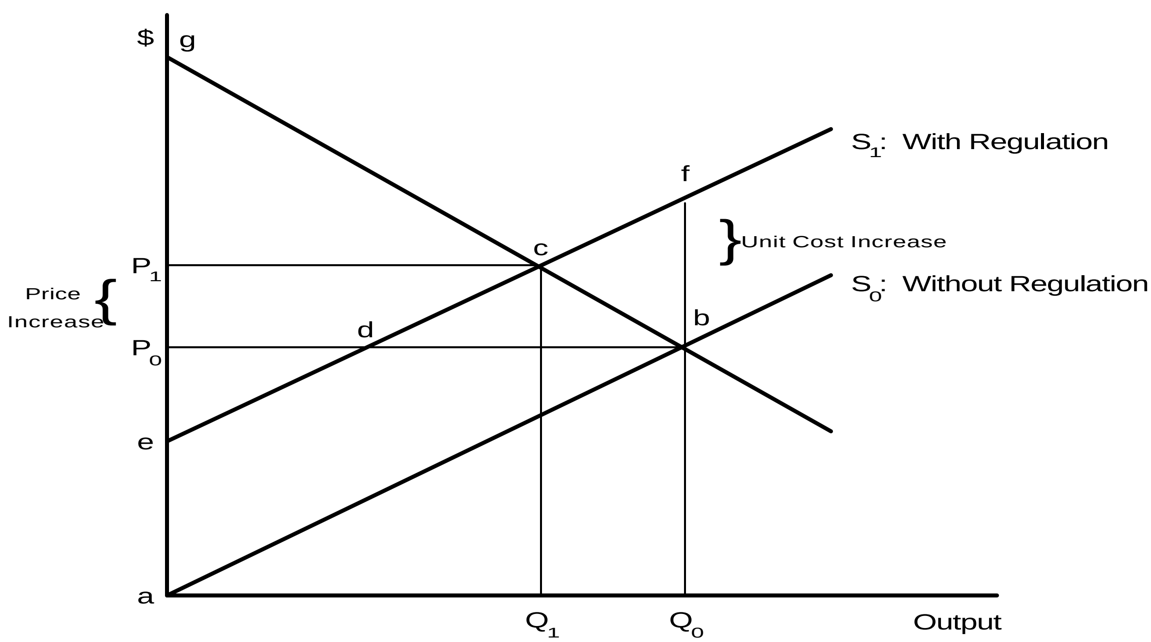

Figure 9-2. Partial-Cost Pass-Through of Regulatory Costs

face a higher price for metal furniture and related products and as a response, they purchase a smaller quantity. The net change in producer surplus is equal to the area abde (loss) - P_0dcP_1 (gain due to a transfer from consumers). Combining the losses in surplus leads to the social costs of the regulation, which is equal to the area abce. This is less than the full compliance costs represented by area abfe in Figure 9-2. Thus, as shown in Table 9-3, the welfare change here is $14.77 million and is composed of a change in both consumer surplus ($7.38 million) and producer surplus ($7.38 million).

9.2.2.4 Summary. As summarized in Table 9-3, the economic welfare impacts for producers, consumers, and society as a whole vary across the three scenarios considered. The largest economic impact would occur if producers made no behavioral change in response the regulation and were to fully absorb the compliance costs of $14.77 million. Consumers would bear no costs; therefore, the total welfare change of society would be equal to the change in welfare experienced by producers. Under partial-cost pass-through, both producers and consumers experience a welfare change. However, in this case, the sum of the loss in welfare is less than the full compliance costs. In full-cost pass-through, the reduction in welfare consumers would incur would also be less than the total estimated compliance costs of $14.77 million.

Regardless of whether the costs of regulating the metal furniture manufacturing industry were fully absorbed by producers or fully passed on to consumers, the per unit costs are negligible. As a result, the effect of this regulation on the price of metal furniture and related products is not distinguishable from random price fluctuations (or 'noise'). Therefore, the trivial magnitude of these relative costs indicate negligible distributional effects of this regulation across society.

9.3 SMALL BUSINESS IMPACTS

This regulatory action will potentially affect the economic welfare of owners of metal furniture surface coating facilities. The ownership of these facilities ultimately falls on private individuals who may be owner/operators that directly conduct the business of the firm (i.e., "mom and pop shops" or partnerships) or, more commonly, investors or stockholders that employ others to conduct the business of the firm on their behalf (i.e., privately-held or publicly-traded corporations). The individuals or agents that manage these facilities have the capacity to conduct business transactions and make business decisions that affect the facility. The legal and financial responsibility for compliance with a regulatory action ultimately rests with these agents; however, the owners must bear the financial consequences of the decisions. While environmental regulations can affect all businesses, small businesses may have special problems in complying with such regulations.

The Regulatory Flexibility Act (RFA) of 1980 requires that special consideration be given to small entities affected by federal regulation. The RFA was amended in 1996 by the Small Business Regulatory Enforcement Fairness Act (SBREFA) to strengthen the RFA's analytical and procedural requirements. Under SBREFA, the EPA implements the RFA as written with a regulatory flexibility analysis required only for rules that will have a *significant* impact on a *substantial* number of small entities. This section examines the metal furniture surface coating industry and provides a preliminary screening analysis to determine whether this rule is likely to impose a significant impact on a substantial number of the small entities (SISNOSE) within this industry. The screening analysis employed here is a "sales test," which computes the annualized compliance costs as a share of sales for each company.

Based on facility responses to the industry questionnaires, the EPA identified the ultimate parent company and obtained their sales and employment data from either their questionnaire response or one of the following secondary sources:

1. Dun and Bradstreet Market Identifiers (Dun & Bradstreet, 1999)
2. Hoover's Company Profiles (Hoover's Inc., 1999)
3. Company Websites.

The facilities that received the questionnaires represent a sample of the total number of facilities included in this source category (estimated at 655 major sources nationwide). Appendix G provides a listing of the 24 companies that own and operate the 62 potentially affected facilities that responded to these questionnaires.

The Small Business Administration (SBA) defines a small business in terms of the sales or employment of the owning entity. These thresholds vary by industry and are evaluated based on the industry classification (SIC/NAICS code) of the impacted facility. Responses to the industry questionnaires indicated multiple SIC/NAICS codes with a small business definition ranging from 100 to 1,000 employees or less than $5 million in annual sales. The EPA developed a company's size standard based on the reported industry classification for these facilities. In cases where companies own facilities with multiple classifications, the primary SIC/NAICS code and associated SBA definition was used. Based on the EPA's database, 10 companies were identified as small (42 percent) and the remaining 14 being large (58 percent) (See Appendix G for detailed listing).

To assess the potential impact of this rule on these small businesses, the EPA calculated the share of annual compliance cost relative to baseline sales for each company (i.e., employed the "sales test"). When a company owns more than one facility, the costs for each facility are summed to develop the numerator of the test ratio, or cost-to-sales ratio (CSR). Annual compliance costs are defined in this analysis as the engineering estimate of regulatory costs imposed on these companies; thus, they do not reflect the changes in production expected to occur in response to imposition of these costs and the resulting market adjustments. Table 9-4 reports total annual compliance costs, the number of companies impacted at the one percent and three percent levels, and summary statistics for the cost-to-sales ratios for small and large companies.

Although small businesses represent 42 percent of the companies sampled within this source category, Table 9-4 shows that their aggregate compliance costs represents only 14 percent, or $176,000, of the industry sample's total of $1.3 million. The annual compliance costs for small businesses range from zero to 0.7 percent of their sales with 30 percent of the small businesses (i.e., 3 out of 10) not incurring any regulatory costs. The vast majority of small companies with sales data have CSRs below 0.5 percent. The mean (median) compliance cost-to-sales ratio is 0.15 (0.10) percent for the identified small businesses and 0.01 (0.01) percent for the large businesses. These results are expected to be "representative" of the distributional impacts across companies by size and, of course, depends upon the sample's representativeness of the total population of potentially affected facilities.

Table 9-4. Summary Statistics for SBREFA Screening Analysis on Metal Furniture Sample: MACT Floor

	Small		Large		All Companies	
Total Number of Companies	10		14		24	
Total Annual Compliance Costs ($\$10^3$/yr)	$176		$1,117		$1,293	
Average TAC per company ($\$10^3$/yr)	$17.6		$79.8		$53.9	
	Number	Share	Number	Share	Number	Share
Companies with Sales Data	10	100%	14	100%	24	100%
Not Impacted, i.e., = 0%	3	30%	2	14%	5	21%
Impacted at >0 to 1%	7	70%	12	86%	19	79%
Impacted at $1 to 3%	0	0%	0	0%	0	0%
Impacted at $3%	0	0%	0	0%	0	0%
Cost-to-Sales Ratios						
Average		0.15%		0.01%		0.06%
Median		0.10%		0.01%		0.01%
Minimum		0.00%		0.00%		0.00%
Maximum		0.70%		0.10%		0.70%

The U.S. Census Bureau (1998) reports the after-tax return to sales for corporations in the Furniture and Fixtures industry grouping at 4.5 percent for 1997. Corporations with less than $25 million in assets within this grouping experienced higher return to sales of 5.1 percent during this time period. Reviewing the range of costs to be borne by small businesses in light of the 4.5 to 5.1 percent profit margins typical of this industry, the EPA has determined the costs are typically small and, overall, do not constitute a significant impact on a substantial number.

Because of the small questionnaire sample, the EPA conducted a supplemental SBREFA screening analysis using the Toxics Release Inventory (TRI) database that was employed by the engineering analysis to estimate the number of major source facilities within this source category. Based on the TRI sample of facilities, the EPA identified the owning entities and obtained sales and employment data where available. A total of 28 small companies were identified from this sample of 57 companies that owned 70 major source facilities. Lacking compliance estimates specific to these facilities, the potential impacts were analyzed using the following costing scenarios:

1. Minimal impact = $17,600 per major source, which reflects the average cost per small business from Table 9-4; and
2. Maximum impact = $53,900 per major source, which reflects the costs for a large model plant.

The minimal impact scenarios is likely to be more representative of the cost impacts for small businesses because they are likely to own facilities represented by the small model plant. Alternatively, the maximum impact scenario is a worst-case costing scenario since most small businesses are not likely to own facilities represented by the large model plant.

The supplemental screening analysis provided the following small business impacts for each cost scenario:

1. Minimal impact had an average CSR of 0.15% (median of 0.09%) with range of 0.04 to 1.04%.
2. Maximum impact had an average CSR of 0.45% (median of 0.27%) with range of 0.13 to 3.15%.

The minimal impact scenario provides results comparable to those summarized in Table 9-4. Although the maximum impact scenario is a worst-case scenario, we observe only 2 of the 28 small companies (7 percent) with CSRs greater than 1 percent, and only 1 small company (3.2 percent) with a CSR > 3 percent. Therefore, the EPA believes that the supplemental analysis confirms the negligible impacts observed from the initial SBREFA screening analysis based on the industry questionnaire.

9.4 REFERENCES

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3. Securities Exchange Commission. 1998. 10-K Reports. <http://www.sec.gov>

4. U.S. Environmental Protection Agency. 1998. Preliminary Industry Characterization: Surface Coating of Metal Furniture. <http://www.epa.gov/ttn/uatw/coat/mfurn/met_furn.html>>.

5. U.S. Department of Commerce, Bureau of the Census. 1993, 1994, 1995, and 1996. Annual Survey of Manufactures.

6. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Metal Household Furniture Manufacturing.

7. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Office Furniture (Except Wood) Manufacturing.

8. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Institutional Furniture Manufacturing.

9. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Showcase, Partitions, Shelving, and Locker Manufacturing.

10. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing.

11. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Residential Electric Lighting Fixture Manufacturing.

12. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Dental Equipment and Supplies Manufacturing.

13. U.S. Department of Commerce, Bureau of the Census. 1997 Economic Census: Manufacturing Industry Series for Laboratory Apparatus and Furniture Manufacturing.

14. U.S. Department of Commerce, Bureau of the Census. 1999. Concentration Ratios in Manufacturing (for the year 1992).

APPENDIX A

EVOLUTION OF THE BACKGROUND INFORMATION DOCUMENT

INTRODUCTION

The objective of the metal furniture integrated rule development project is to develop a technical basis for supporting the proposed NESHAP for the metal furniture source category. This BID represents our current state of knowledge on the metal furniture source category.

To accomplish this objective, technical data were acquired on the following aspects of the metal furniture source category (1) representative processes and operations, (2) product characteristics, (3) HAP emission points, including magnitude and composition of HAP emissions, and (4) the types and costs of control options applicable to identified HAP emission points in this source category. The primary sources of technical data included (1) technical references and literature, (2) State and local regulatory agencies, (3) site visits, (4) contact with representatives of the metal furniture industry and trade associations, and (5) distribution of a section 114 questionnaire to metal furniture companies, including summarization and analysis of the data collected in this effort.

A chronological history of the development and evolution of significant events relating to the emergence of the BID are presented in Table A-1.

TABLE A-1. EVOLUTION OF THE BID

Date	Company, consultant, or agency and location	Nature of action
04/08/97	U.S. Environmental Protection Agency, State and Local agencies, and Industry Durham, NC	U.S. Coating Workshop with EPA, State and Local agencies, and Industry to familiarize them with the regulatory process.
04/09/97	U.S. Environmental Protection Agency, State and Local agencies, and Industry Durham, NC	Coating Regulations Workshop Metal Furniture/Large Appliance Breakout Session. Discussion of the rule development process and an informal question and answer section. Also, introduction of key persons in the rule development process.
05/11/97	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Durham, NC	Draft example of completed questionnaire response for review and comment.
05/14/97	Metal Creations High Point, NC	Site visit to High Point facility.
05/14/97	U. S. Furniture Industries High Point, NC	Site visit to High Point facility.
05/28/97	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Research Triangle Park, NC	First Roundtable Meeting (P-MACT/P-BAC Phase) with EPA/Industry/States Working Team.
06/11/97	Nevin Laboratories, Incorporated, Chicago, IL Steelcase, Incorporated, Grand Rapids, MI Kimball, Incorporated, Jasper, IN HON Industries, Muscatine, IA Pelton & Crane Company, Charlotte, NC Allsteel, Incorporated, Milan, TN Darling Store Fixtures, Paragould, AR Lozier Corporation, Omaha, NE	Distribution of section 114 questionnaire.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
06/30/97	The HON Company A Division of HON Industries Cedartown, GA	Response to June 1997 section 114 questionnaire. Response for Cedartown plant.
06/30/97	Steelcase Incorporated Kentwood, MI	Site visit to Corporate Development Center.
07/01/97	Steelcase Incorporated Grand Rapids, MI	Site visit to Desk Plant and File Plant.
07/02/97	American Seating Company Grand Rapids, MI	Site visit to Grand Rapids facility.
07/07/97	Darling Store Fixtures Paragould, AR	Response to June 1997 section 114 questionnaire. Response for Paragould, AR and Corning, AR facilities.
07/09/97	Steelcase, Incorporated Grand Rapids, MI	Response to June 1997 section 114 questionnaire. Response contained in Confidential Business Information File.
07/09/97	Kimball International Jasper, IN	Response to June 1997 section 114 questionnaire. Response for (Artec Panel) Plant, Jasper, IN and Harpers, Post Falls, ID.
07/10/97	HON Industries, Incorporated Muscatine, IA	Response to June 1997 section 114 questionnaire. Response for Oak Steel metal case goods facility and Geneva chair plant.
07/10/97	Nevin Laboratories, Incorporated Chicago, IL	Response to June 1997 section 114 questionnaire.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
07/11/97	Siemens Medical System, Incorporated Pelton and Crane Group Charlotte, NC	Response to June 1997 section 114 questionnaire.
07/17/97	Lozier Corporation Omaha, NE	Response to June 1997 section 114 questionnaire. Response for Omaha, Nebraska-North Plant, Omaha, Nebraska-West Plant and Scottsboro, Alabama Plant.
07/21/97	Allsteel, Incorporated Milan, TN	Response to June 1997 section 114 questionnaire. Response for Milan, TN, Tupelo Systems, and Jackson Seating facilities.
07/21/97	Stanley Environmental, Incorporated Coralville, LA	Response to request for additional information for HON Industries section 114 questionnaire.
07/22/97	Husted, Husted and Associates, Incorporated High Point, NC	Transmittal of site visit questionnaire for Metal Creations.
07/29/97	Lozier Corporation Omaha, NE	Facsimile transmitting paintline coverage data.
07/30/97	Steelcase, Incorporated Grand Rapids, MI	Transmittal of Material Safety Data Sheets (MSDS's).
07/31/97	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Research Triangle Park, NC	Second Roundtable Meeting (P-MACT/P-BAC Phase) with EPA/Industry/States Working Team.
08/04/97	U.S. Environmental Protection Agency and Regulatory Subgroup Research Triangle Park, NC	Metal Furniture Integrated Rule Development (P-MACT/P-BAC Phase), Regulatory Subgroup Teleconference.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
08/07/97	HON Industries Cedartown, GA	Site visit to Cedartown Plant.
08/22/97	Steelcase, Incorporated Grand Rapids, MI	Transmittal of corrected TRIS data and response to information request of July 21, 1997, based on the June 1997 section 114.
09/02/97	Steelcase, Incorporated Grand Rapids, MI	Transmittal of revised pages 11b and 12b to the section 114 submittal.
03/19/98	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Research Triangle Park, NC	Third Roundtable Meeting (P-MACT/P-BAC Phase) with EPA/Industry/States Working Team.
04/15/98	Royal Development High Point, NC	Site visit to High Point facility.
04/16/98	Charleston Forge Boone, NC	Site visit to Boone facility.
04/16/98	Johnson Casualties North Wilkesboro, NC	Site visit to North Wilkesboro facility.
05/11/98	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Durham, NC	Posting of DRAFT Example of completed questionnaire response. Posted on the Metal Furniture website.
05/15/98	BIFMA International Grand Rapids, MI	Electronic mail - Comments on the draft information collection request, including attachment of an alternative form set.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
06/03/98	Accuride International, Sante Fe Springs, CA Identical letters sent to: Atlas Spring Manufacturing Corporation, Gardena, CA Hickory Springs Manufacturing Co., Hickory, NC National Metal Industries, West Springfield, MA Rabun Metal Products Incorporated, Tiger, GA Stylelander Metal Stampings, Inc., Verona, MS United Receptacle, Pottsville, PA	Distribution of section 114 industry questionnaire for Metal Furniture Parts and Hardware Manufacturing Companies.
06/03/98	B Line Systems, Incorporated, Highland, OH Identical letters sent to: Framecrafters, Chicago, IL Penco Products Incorporated, Oaks, PA Republic Storage Systems, Canton, OH Sunlight Casual Furniture, Paragould, AR	Distribution of section 114 industry questionnaire for Miscellaneous Metal Furniture Products Manufacturing Companies.
06/03/98	A-Dec, Incorporated, Newburg, OR Identical letters sent to: Den-Tal-Ez Manufacturing, Bay Minette, AL Medical Lab Automation, Incorporated, Pleasantville, NY Sheldon Lab Systems, Crystal Springs, MS	Distribution of section 114 industry questionnaire for Laboratory and Dental Furniture Manufacturers.
06/03/98	Davies Office Refurbishing, Incorporated, Albany, NY Identical letters sent to: Furniture Medic International, Memphis, TN Office Repair and Services, San Francisco, CA Professional Refinishing, Los Angeles, CA	Distribution of section 114 industry questionnaire for Furniture Repair Operation Companies.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
06/03/98	A&J Manufacturing Company, Tustin, CA Identical letters sent to: American Desk Manufacturing, Temple, TX Cramer, Incorporated, Kansas City, KS Crown Metal Manufacturing, Elmhurst, IL Dehler Manufacturing, Chicago, IL Edsal Manufacturing, Chicago, IL Virco Manufacturing, Torrance, CA Steelcase, Incorporated, Grand Rapids, MI HON Industries, Muscatine, IA	Distribution of section 114 industry questionnaire for Household, Office, and Public Building Furniture and Store Fixtures, Partitions and Shelving Companies.
06/03/98	Venture Lighting International, Solon, OH Identical letters sent to: Lightolier, Incorporated, Fall River, MA Mid-West Chandelier Company, Kansas City, KS Lithonia Lighting Company, Conyers, GA	Distribution of section 114 industry questionnaire for Residential and Commercial Lighting Fixture Companies.
06/11/98	Sheldon Laboratory Systems Crystal Springs, MS	Transmittal of letter explaining Sheldon Laboratory Systems' status in regard to the June 1998, section 114 questionnaire.
06/18/98	Medical Laboratory Automation, Inc. Pleasantville, NY	Transmittal of letter regarding status of the June 1998, section 114 questionnaire response.
06/24/98	Leggett & Platt Incorporated Carthage, MO	Transmittal of letter stating that the Leggett & Platt Stylelander facility in Verona, Mississippi is no longer used for manufacturing.
07/01/98	Venture Lighting Solon, OH	Transmittal of letter stating Venture Lighting's status in regard to the June 1998 section 114 questionnaire request.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
07/16/98	Accuride International Inc. Santa Fe Springs, CA	Transmittal of letter stating Accuride's status in regard to the June 1998 section 114 questionnaire request.
07/21/98	A&J Manufacturing Company Brea, CA	Transmittal of letter stating that all surface coating operations are procured from outside suppliers.
07/28/98	U.S. Environmental Protection Agency and Recipients of the Surface Coating of Metal Furniture Questionnaire Durham, NC	Distribution of clarifications to the June 1998 questionnaire.
07/29/98	Leggett & Platt Incorporated Carthage, MO	Transmittal of memorandum detailing metal furniture facilities completing June 1998 section 114 response.
08/17/98	Davies Office Refurbishing Albany, NY	Transmittal of completed section 114 questionnaire response.
08/17/98	Adec Newberg, OR	Transmittal of letter concerning section 114 questionnaire request.
08/18/98	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Durham, NC	Distribution of coating calculation sheet for use in completing the industry questionnaire.
08/19/98	Republic Storage Systems Company Canton, OH	Transmittal of completed section 114 questionnaire response.
08/20/98	EST Division of Leggett Partners, L.P. Leggett & Platt Incorporated Carthage, MO	Transmittal of completed section 114 questionnaire response for the Grafton, WI facility.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
08/20/98	Leggett & Platt Incorporated High Point, NC	Transmittal of completed section 114 questionnaire response for High Point Sleeper.
08/20/98	Leggett & Platt Incorporated Carthage, MO	Transmittal of completed section 114 questionnaire response for the Simpsonville, KY facility.
08/20/98	Leggett & Platt Incorporated Carthage, MO	Transmittal of completed section 114 questionnaire response for the Linwood Branch facility.
08/20/98	Leggett & Platt Incorporated Carthage, MO	Transmittal of completed section 114 questionnaire response for Duro Metal Manufacturing facility in Dallas, TX.
08/20/98	Hickory Springs Manufacturing Company Hickory, NC	Transmittal of completed section 114 questionnaire response for the Hickory, NC Metal Plant and the Fort Smith, AR Metal Plant.
08/20/98	Virco Manufacturing Corporation Torrance, CA	Transmittal of completed section 114 questionnaire response.
08/21/98	Steelcase Incorporated Grand Rapids, MI	Transmittal of completed section 114 questionnaire response for the Chair I, Revest-Dallas, and Revest-Atlanta facilities.
08/21/98	The HON Company Muscatine, IA	Electronic mail transmittal of section 114 questionnaire status.
08/21/98	Arco Bell Corporation Temple, TX (Originally sent under the previous company name of American Desk)	Distribution of section 114 industry questionnaire for Household, Office, and Public Building Furniture and Store Fixtures, Partitions and Shelving Companies.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
08/24/98	National Metal Industries West Springfield, MA	Transmittal of completed section 114 questionnaire response.
08/24/98	B-Line Systems Highland, IL	Transmittal of completed section 114 questionnaire response for the Highland Plant.
08/24/98	Lightolier Fall River, MA	Transmittal of completed section 114 questionnaire response for the Fall River facility.
08/24/98	Mid-West Chandelier Company Kansas City, KS	Transmittal of completed section 114 questionnaire response.
08/24/98	Crown Metal Manufacturing Company Elmhurst, IL	Transmittal of completed section 114 questionnaire response.
08/24/98	Lithonia Lighting Conyers, GA	Transmittal of completed section 114 questionnaire responses for Lithonia Electronic Systems Group, Lithonia Lighting-Conyers, Lithonia Lighting-Lithonia West, Lithonia Lighting-Hi Tek Division, Lithonia Lighting-Cochran, and Lithonia Down Lighting.
08/24/98	Collier-Keyworth, Incorporated Leggett and Platt, Incorporated Liberty, NC	Transmittal of completed section 114 questionnaire response.
08/24/98	The HON Company Muscatine, IA	Transmittal of completed section 114 questionnaire response for the Geneva Plant.
08/24/98	The HON Company Muscatine, IA	Transmittal of completed section 114 questionnaire response for the Oak Steel Plant.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
08/24/98	HON Industries, Allsteel Jackson, TN	Transmittal of completed section 114 questionnaire response for the Jackson facility.
08/24/98	The HON Company South Gate, CA	Transmittal of completed section 114 questionnaire response for the South Gate facility.
08/24/98	The HON Company Winnsboro, SC	Transmittal of completed section 114 questionnaire response for the Winnsboro Plant.
08/24/98	The HON Company, Allsteel West Hazelton, PA	Transmittal of completed section 114 questionnaire response for the West Hazleton facility.
08/24/98	Leggett & Platt, Incorporated Winchester, KY	Transmittal of completed section 114 questionnaire response for the Winchester, KY facility.
08/24/98	Leggett & Platt, Incorporated A Division of Dresher Incorporated York, PA	Transmittal of completed section 114 questionnaire response for Harris Hub facility.
08/24/98	Leggett & Platt, Incorporated Whittier, CA	Transmittal of completed section 114 questionnaire response for the Whittier, CA facility.
08/25/98	Penco Products, Incorporated Oaks, PA	Transmittal of completed section 114 questionnaire response for the Newtown Square, PA facility.
08/25/98	Atlas Spring Manufacturing Corporation Gardenia, CA	Transmittal of completed section 114 questionnaire response.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
08/25/98	Dehler Manufacturing Company, Incorporated Chicago, IL	Transmittal of completed section 114 questionnaire response.
08/98	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Durham, NC	Distribution of the Draft Preliminary Industry Characterization: Surface Coating of Metal Furniture.
09/02/98	Leggett & Platt, Incorporated Tupelo, MS	Transmittal of completed section 114 questionnaire response for the Super Sagless facility in Tupelo, MS.
09/04/98	The HON Company Cedartown, GA	Transmittal of completed section 114 questionnaire response for the Cedartown, GA facility.
09/11/98	Steelcase Incorporated Grand Rapids, MI	Transmittal of completed section 114 questionnaire response for the Computer Furniture Plant, File Plant, Desk Plant, Tustin Plant, and Athens Plant facilities.
09/24/98	Professional Refinishing Organization Newport Beach, CA	Transmittal of completed section 114 questionnaire response.
09/25/98	Steelcase Incorporated Grand Rapids, MI	Transmittal of completed section 114 questionnaire response for the Panel Plant, Context Plant and Systems I Plant facilities.
09/98	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Durham, NC	Distribution of the Preliminary Industry Characterization: Surface Coating of Metal Furniture.

TABLE A-1. EVOLUTION OF THE BID (continued)

Date	Company, consultant, or agency and location	Nature of action
10/06/98	Dental EZ Bay Minette, AL	Transmittal of completed section 114 questionnaire response.
07/13/99	U.S. Environmental Protection Agency and Persons Interested in the Surface Coating of Metal Furniture Rule Development Research Triangle Park, NC	Fourth Pre-MACT (EPA/Industry/States) Working Team Meeting
07/16/99	Hickory Springs Manufacturing Company Hickory, NC	Transmittal of letter regarding floor calculation.

APPENDIX B

PARTICIPANTS IN THE DATA COLLECTION EFFORT

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
EPA Representatives				
Mohamed Serageldin	U.S. EPA	OAQPS/ESD/CCPG (C539-03) Research Triangle Park, NC 27711	(919) 541-2379 fax-(919) 541-5689	serageldin.mohamed@epa.gov
Karen Borel	U.S. EPA	Air Permits Branch 61 Forsyth Street Atlanta, GA 30303	(404) 562-4300 fax-(404) 562-9019	borel.karen@epa.gov
Kathy Davey	U.S. EPA	OPPTS-OPPT PPD Mail Code 7409 401 M Street, S.W. Washington, DC 20460	(202) 260-2290 fax-(202) 260-0178	davey.kathy@epa.gov
Bob Rose	U.S. EPA	OSDBU Mail Code 1230-C 401 M Street, S.W. Washington, D.C. 20460	(202) 564-9744 fax-(202) 565-2078	rose.bob@epa.gov
Scott Throwe	U.S. EPA	OECA Mail Code 2223A 401 M Street, S.W. Washington, D.C. 20460	(202) 564-7013 fax-(202) 564-0050	throwe.scott@epa.gov
Eric Wilkinson	U.S. EPA	OPPTS/ PPD Mail Code 7409 401 M Street, S.W. Washington, D.C. 20460	(202) 260-3575 fax-(202) 260-0178	wilkinson.eric@epa.gov

Consultants

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
David Hendricks	EC/R Incorporated	2327 Englert Drive Suite 100 Durham, NC 27713	(919) 484-0222 ext. 335 fax-(919) 484-0122	hendricks.david@ecrweb.com
Karen Holmes	EC/R Incorporated	2327 Englert Drive Suite 100 Durham, NC 27713	(919) 484-0222 ext. 310 fax-(919) 484-0122	holmes.karen@ecrweb.com
State Representatives				
Ken Barrett	Alabama DEM	Air Division P.O. Box 301463 Montgomery, AL 36130-1463	(334) 271-7870 fax-(334) 279-3044	
Dan Belik	Bay Area AQMD	939 Ellis Street San Francisco, CA 94109	(415) 749-4786 fax-(415) 928-0338	
Bob Colby	Chattanooga/ Hamilton County Air Pollution Control Bureau	3511 Rossville Boulevard Chattanooga, TN 37407-2495	(423) 867-4321 fax-(423)867-4348	
Stan Cowen	Ventura County APCD	669 County Square Drive Ventura, CA 93003	(805) 645-1408 fax-(805) 645-1444	
Somnath Dasgupta	Iowa Waste Reduction Center		fax-(319) 268-3733	
Jorge Deguzman	Sacramento Metropolitan APCD		fax-(916) 386-7040	
Cindy Eisfelder	Michigan DEQ		fax-(517) 241-7440	
Jon Heinrich	Wisconsin DNR		fax-(608) 267-0560	

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Robert Hodanbosi	Ohio EPA		fax-(614) 644-3681	
Susan Hoyle	Pennsylvania Bureau of Air Quality	400 Market Street 12th Floor Harrisburg, PA 17105-8468	(717) 787-9257 fax-(717) 772-2303	shoyle@state.pa.us
Lee Huo	San Joaquin Valley Unified APCD	1999 Tuolumne Suite 200 Fresno, CA 93721	(209) 497-1075 fax-(209) 233-0140	
Dick Johnson	Placer County APCD	11464 B Avenue Dewitt Center Auburn, CA 95603	(916) 889-7130 fax-(916) 889-7107	
Jimmy Johnson	Georgia Department of Natural Resources	Air Protection Branch 4244 International Parkway Suite 120 Atlanta, GA 30354	(404) 363-7127 fax-(404) 363-7100	
Martha Lee	Sacramento Metropolitan APCD	8411 Jackson Road Sacramento, CA 95826	(916) 386-6660 fax-(916) 386-6674	
Fred Lettice	South Coast AQMD	21865 East Copley Drive Diamand Bar, CA 91765	(909) 396-2576 fax-(909) 396-2608	
Christy Myers	Alabama DEM	Air Division P.O. Box 301463 Montgomery, AL 36130-1463	(334) 271-7861 fax-(334) 279-3044	
Hank Naour	Illinois EPA	Bureau of Air P.O Box 19506 Springfield, IL 62794-9506	(217) 785-1716 fax-(217) 524-5023	hank.naour@epa.gov.state.il.us

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Todd Nishikawa	Placer County APCD		fax-(530) 889-7107	
Venkata Panchakarla	Florida Department of Environmental Protection	Mail Station #5500 2600 Blair Stone Road Tallahassee, FL 32399	(850) 488-0114 fax-(850) 922-6979	panchakarla_v@dep.state.fl.us
John Patten	Tennessee Department of Environmental Conservation	Division of Air Pollution Control L&C Annex, Ninth Floor 401 Church Street Nashville, TN 37243-1531	(615) 532-0554 fax-(615) 532-0614	
John Ramsey	Kansas Department of Health and Environment	Forbes Field, Building 740 Topeka, KS 66620	(913) 296-1593 fax-(913) 296-1545	
Frank St. Clair	Mojave Desert AQMD	15428 Civic Drive Suite 200 Victorville, CA 92392-2383	(760) 245-1661 x6101 fax-(760) 245-2022	
Doug Wagner	Indiana Department of Environmental Management	Office of Air Management 100 North Senate P.O. Box 6015 Indianapolis, IN 46206-6015	(317) 232-0286 fax-(317) 232-6749	
Richard Wales	Mojave Desert - Antelope Valley APCD	15428 Civic Drive Suite 200 Victorville, CA 92392-2383	(760) 245-1661 fax-(760) 245-2699	
Industry Representatives				
Thomas Ashley	Charleston Forge	251 Industrial Park Drive Boone, NC 28607	(704) 264-0100 fax-(704) 264-5901	

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Quentin Baker	Royal Development Company	325 Kettering Road High Point, NC 27263	fax-(336) 889-6736	royal@northstate.com
Clyde Blaco	NASFM	3595 Sheridan Street Suite 200 Hollywood, FL 33021	(954) 893-7300 ext. 27 fax-(954) 893-7500	
Kevin Booth	Penco Products	4080 West Farm Road West Jordan, Utah 84088	(801) 280-1541 fax-(801) 280-3450	kevin.booth@pencoproducts.com
Steve Byrne	Cytec	1300 Mt. Kemble Avenue Morristown, NJ 07960	(973) 425-8406 fax-(973) 425-0185	steve_byrne@gm.cytec.com
Carlos Casillas	Leggett & Platt	P.O. Box 4956 Whittier, CA 90602	(562) 945-2641 fax-(562) 945-3190	
Andy Counts	American Furniture Manufacturers Association	P.O. Box HP-7 High Point, NC 27261	(910) 884-5000 fax-(910) 884-5303	acounts@ng.infi.net
Jennifer Depolo	Leggett & Platt	P.O. Box 140 Linwood, NC 27299	(336) 956-5000 fax-(336) 956-5013	jdepololegg@aol.com
Mick Durham	Stanley Environmental	225 Iowa Avenue Muscatine, IA 52761	(319) 264-6342 fax-(319) 264-6658	durhammick@stanleygroup.com
William English	PPG Industries	One PPG Place Pittsburgh, PA 15272	(412) 434-3198 fax-(412) 434-3705	
Robert Eshbach	Republic Storage Systems	1038 Beldon Avenue N.E. Canton, OH 44705	(330) 454-5800 fax-(330) 454-7772	beshbach@republicstorage.com
Steve Foster	Johnson Casuals		fax-(336) 667-0998	

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Ken Gabele	The Sherwin-Williams Company	101 Prospect Avenue, N.W. Cleveland, OH 44115-1075	(216) 566-3316 fax-(216) 556-2920	klgabele@sherwin.com
Charlie Gardner	Leggett & Platt	2017 South Green Street Tupelo, MS 38802	(662) 791-7136 fax-(662) 791-7187	
Walt Hammond	Thomasville Furniture Industries	P.O. Box 339 Thomasville, NC 27361-0339	(910) 476-2263 fax-(910) 472-4080	
Madelyn Harding	The Sherwin-Williams Company	101 Prospect Avenue, N.W. Cleveland, OH 44115-1075	(216) 566-2630 fax-(216) 556-2730	mkharding@sherwin.com
Mary Husted	Husted & Associates	P.O. Box 5256 High Point, NC 27262	(910) 869-3097 fax-(910) 869-3031	
Michael Jonas	Lozier Corporation	6336 Pershing Drive Omaha, NE 68110	(402) 457-8497 fax-(402) 457-8554	mjonas@compuserve.com
Dennis Kane	Leggett & Platt	915 Woodland View Drive York, PA 17402	(717) 843-6288 fax-(717) 843-6185	
Glen Kedzie	National Paint and Coatings Association	1500 Rhode Island Avenue, NW Washington, DC 20005	(202) 462-6272 fax-(202) 328-0688	gkedzie@paint.org
Terry Knight	B-Line Systems	509 W. Monroe Highland, IL 62249	(618) 654-2184 fax-(618) 654-2184	tknight@cooperbline.com
Albert Kula	Leggett & Platt	P.O. Box 7327 High Point, NC 27264	(336) 889-4998 fax-(336) 889-5066	
Sidney Lefkovitz	Mid-West Chandelier	P.O. Box 15097 Kansas City, KS 66115	(913) 281-1100 fax-(913) 281-1967	

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Scott Lesnet	HON Industries	SM4 Technical Center 505 Ford Avenue Muscatine, IA 52761	(319) 262-7865 fax-(319) 262-7899	lesnet@honcompany.com
Charles Lindsey	Leggett & Platt Duro Metal Manufacturing	P.O. Box 170520 Dallas, TX 75217	(214) 391-3181 fax-(214) 391-7629	charles.lindsey@gte.net
Diane Luo	Pelton & Crane	11727 Fruehauf Drive Charlotte, NC 28241	(704) 587-7294 fax-(704) 587-7214	
Bob Maindelle	WilsonArt International		fax-(254) 207-2948	
Archie Martz	Lilly Industries	P.O. Box 2358 High Point, NC 27261	(910) 802-4326 (910) 889-2157 fax-(910) 889-6007	
Jeffery Masi	Allsteel, Inc.	71 Denton Fly Road Milan, TN	(901) 686-4116 fax-(901) 686-4120	
Richard Mathis	Metal Creations	P.O. Box 1104 High Point, NC 27261	(910) 889-2083 fax-(910) 885-2442	
Dave Mazzocco	PPG Industries	4325 Rosanna Drive Allison Park, PA 15101	(412) 492-5476 fax-(412) 492-5377	mazzocco@ppg.com
Michael McMullen	American Seating Company	401 American Seating Center Grand Rapids, MI 49504	(616) 732-6650 fax-(616) 732-6401	mcmullen@amscco.com
David McNeil	Hickory Springs	P.O. Box 128 Hickory, NC 28603	(828) 328-2201 fax-(828) 324-4715	davemcn@twavenet

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Mary Ellen Mika	Steelcase, Inc.	P.O. Box 1967 Mail Code: PS Grand Rapids, MI 49501	(616) 246-9787 fax-(616) 246-9191	mmika@steelcase.com
Brad Miller	BIFMA International	2680 Horizon Drive, SE Suite A-1 Grand Rapids, MI 49546	(616) 285-3963 fax-(616) 285-3765	bmiller@bifma.com
Chuck Millisor	Leggett & Platt	P.O. Box 1109 Liberty, NC 27298	(336) 622-0120 fax-(336) 622-1050	cmillisor@mindspring.com
Bob Nelson	National Paint and Coatings Association	1500 Rhode Island Avenue, NW Washington, DC 20005	(202) 462-6272 fax-(202) 462-8549	bnelson@paint.org
Robert Nevin	Nevin Laboratories		fax-(773) 624-7337	
Loc Nguyen	Davies Office Refurbishing	40 Loudonville Road Albany, NY 12204	(518) 449-2040 fax-(518) 449-4036	
Mary Ellen Roddy	National Paint and Coatings Association	1500 Rhode Island Avenue, NW Washington, DC 20005	(202) 462-6272 fax-(202) 462-8549	mroddy@paint.org
Rhonda Ross	Warner, Norcross & Judd (for BIFMA)	2000 Town Center Southfield, MI 48075	(284) 784-5088 fax-(284) 784-3250	rross@wnj.com
Larry Runyan	American Furniture Manufacturers Association	P.O. Box HP-7 High Point, NC 27261	(910) 884-5000 fax-(910) 884-5303	lfrun@aoi.com
Stan Schmitt	Kimball, Inc.	1155 West 12th Avenue Jasper, IN 47549	(812) 634-3274 fax-(812) 634-3250	staschm@kimball.com

TABLE B-1. LIST OF STAKEHOLDERS

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
Jim Sell	National Paint and Coatings Association	1500 Rhode Island Avenue, NW Washington, DC 20005	(202) 462-6272 fax-(202) 462-8549	jsell@paint.org
Jo Spiceland	Charleston Forge	251 Industrial Park Dr. Boone, NC 28607	(828) 264-4901 fax-(828) 264-5901	kspiceland@yahoo.com
Andy Sticker	Darling Store Fixtures		fax-(870-239-6429	
Sherry Stookey	Lilly Industries	P.O. Box 2358 High Point, NC 27261	(336) 802-43305 fax-(336) 889-6007	stookeys@lillyindustries.com
Ron Tucker	Lilly Industries	2137 Brevard Road High Point, NC 27261	(910) 802-4337 fax-(910) 889-6007	
Wayne Vangsness	National Metal Industries	203 Circuit Avenue West Springfield, MA 01089	(413) 785-5861 fax-(413) 737-2309	
Robert Walp	Penco Products	99 Brower Avenue Oaks, PA 19456	(610)666-0500 fax-(610) 650-5257	bwalp@pencoproducts.com
Ronald Westgate	Lightolier	631 Airport Road Fall River, MA 02720	(508) 646-3341 fax-(508) 674-4710	rwestgate@gentyte.com
Bob Wood	Lexington Furniture Industries	P.O. Box 1008 Boone, NC 27293	(910) 249-5316 fax-(910) 249-5588	bwood@infoave.net
Lynn Zimmerman	Steelcase, Inc.	P.O. Box 1967 Mail Code: PS Grand Rapids, MI 49501	(616) 475-2183 fax-(616) 246-9191	lzimmer1@steelcase.com
Bernard Zysman	Occidental Chemical	P.O. Box 344 Niagara Falls, NY 14302	(716) 278-7894 fax-(716) 278-7297	bernie_zysman@oxy.com

TABLE B-2. METAL FURNITURE SITE VISIT FACILITIES

COMPANY VISITED	PRODUCTS PRODUCED
American Seating Company Grand Rapids, Michigan	Stadium Seating and Public Transportation Seating
Charleston Forge Boone, North Carolina	Residential Furniture
HON Industries Cedartown, Georgia	Office Furniture
Johnston Casuals North Wilkesboro, North Carolina	Residential Furniture
Metal Creations High Point, North Carolina	Residential Furniture
Steelcase, Incorporated Grand Rapids, Michigan (Two Facilities)	Office Furniture
Royal Development High Point, North Carolina	Recliner Mechanisms
U.S. Furniture High Point, North Carolina	Residential Furniture

TABLE B-3. METAL FURNITURE INDUSTRY QUESTIONNAIRE RECIPIENTS

Facility Name	City	State
Lozier Corporation - Scottsboro Plant	Scottsboro	AL
Steelcase - Athens Plant	Athens	AL
Dental Ez Group	Bay Minette	AL
Darling Store Fixtures - Paragould Plant	Paragould	AR
Darling Store Fixtures - Corning Plant	Corning	AR
Hickory Springs Manufacturing Compant	Fort Smith	AR
The HON Company - South Gate	South Gate	CA
Professional Refinishing Organization	Los Angeles	CA
Atlas Spring Manufacturing Organization	Gardena	CA
Virco Manufacturing Corporation	Torrance	CA
Leggett & Platt Incorporated	Whittier	CA
Steelcase - Tustin Facility	Tustin	CA
Revest, Incorporated	Lithia Springs	GA
Lithonia Down Lighting	Vermillion	GA
The HON Company - Cedartown Facility	Cedartown	GA
The HON Company - Oak Steel Facility	Muscatine	IA
Harpers, Incorporated	Post Falls	ID
B-Line Systems - Highland Plant	Highland	IL
Artec Manufacturing	Jasper	IN
Mid-West Chandelier Company	Kansas City	KS
Leggett & Platt, Incorporated	Simpsonville	KY
Leggett & Platt, Incorporated	Winchester	KY
Lightolier - Fall River Facility	Fall River	MA
National Metal Industries	West Springfield	MA
Steelcase - Systems I Plant	Grand Rapids	MI
Steelcase - Computer Furniture Plant	Kentwood	MI

TABLE B-3. METAL FURNITURE INDUSTRY QUESTIONNAIRE RECIPIENTS (cont.)

Facility Name	City	State
Steelcase - Desk Plant	Grand Rapids	MI
Steelcase - Panel Plant	Kentwood	MI
Steelcase - File Plant	Grand Rapids	MI
Steelcase - Chair I Plant	Grand Rapids	MI
Steelcase - Context Plant	Kentwood	MI
Super Sagless	Tupelo	MS
PENCO Products	Vicksburg	MS
Metal Creations	High Point	NC
Leggett & Platt - Linwood Branch Facility	Linwood	NC
Collier-Keyworth, Incorporated	Liberty	NC
High Point Sleeper	High Point	NC
Hickory Springs Manufacturing Company	Hickory	NC
Lozier Corporation - Omaha North Plant	Omaha	NE
Lozier Corporation - Omaha West Plant	Omaha	NE
Davies Office Refurbishing, Incorporated	Albany	NY
Republic Storage Systems Company, Incorporated	Canton	OH
PENCO Products	Oaks	PA
Harris Hub	York	PA
HON/ALLSTEEL	West Hazelton	PA
Duro Metal Manufacturing	Dallas	TX
Revest, Incorporated	Farmers Branch	TX
PENCO Products - Salt Lake Plant	West Jordan	VT
EST Division of Leggett Partners	Grafton	WI

TABLE B-4. SUMMARY OF DATA CONTRIBUTED TO THE EPA FROM STATES

State/Local Agency	Data Contributed
Alabama DEM	Listing of metal furniture manufacturing facilities
Bay Area AQMD (California)	Emission inventory listing and Regulation 8, Rule 14: Surface Coating of Large Appliances and Metal Furniture
South Coast AQMD (California)	AQMD Rule 1107-Coating of Metal Parts and Products, and AQMD BACT for metal furniture
Ventura County APCD (California)	Facility permits
California Air Resources Board	ARB Database of surface coating facilities
Illinois EPA	Title V permit applications for three facilities; Initial CAAPP permits for three facilities, facility list of metal furniture manufacturers
Indiana	Airs Facility Subsystem Quick Look Report, Facility emissions data by SCC code, and Voluntarily reported data for the 189 HAPs
Michigan	Seven Title V permit applications and multiple operating permit applications
Missouri DNR	Facility operating permits, emissions inventories, Title V permit applications
Ohio EPA	STARDUST Database, Ohio BAT Clearinghouse Data, and Title V permit applications for three facilities
Tennessee Metropolitan Government of Nashville and Davidson Counties	Construction permit, Title V permit for one facility, VOC Report, and Construction and Operating Permit for one facility
Chattanooga-Hamilton County APCB (Tennessee)	Engineering reports for two facilities, Material Safety Data Sheets on powder coating
Texas	Chapter 115 surface coating rules and definitions, database and mailing list for fabricated metal products
Wisconsin DNR	Listing of Title V and synthetic minor facilities

APPENDIX C

STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE AND NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE DATA SUMMARIES

TABLE C-1. SIC CODES
(All products listed for each code are metal furniture)

SIC Code	Description	Typical Products
2514	Metal Household Furniture	Bookcases, Chairs, Tables, Swings, Kitchen Cabinets, Medical Cabinets, Camp Furniture, Frames for Boxsprings, Cribs, Cots, Garden Furniture, Serving Carts
2522	Office Furniture, Except Wood	Bookcases, Chairs, Tables, Desks, File Cabinets, Wall Cases, Partitions, Modular Furniture, Benches
2531	Public Building and Related Furniture	Benches, Portable Bleacher Seating, Stadium Seating, Theater Seating, School Furniture, Church Furniture
2542	Office and Store Fixtures, Partitions, Shelving, and Lockers, Except Wood	Cabinets, Counters, Display Cases, Display Fixtures, Bar Fixtures, Shelving, Showcases, Sorting Racks, Lunchroom Fixtures
3645	Residential Electric Lighting Fixtures	Chandeliers, Floor Lamps, Lamps, Wall Lamps, Desk Lamps, Lamp Shades (metal), Table Lamps
3646	Commercial, Industrial, and Institutional Electric Lighting Fixtures	Chandeliers (commercial), Desk Lamps

TABLE C-2. SIC CODES
(Only products listed are metal furniture[a])

SIC Code	Description	Typical Products
2599	Furniture and Fixtures, Not Elsewhere Classified	Hospital Beds, Bowling Center Furniture, Cafeteria Furniture, Factory Furniture, Ship Furniture
3429	Hardware, Not Elsewhere Classified	Furniture Hardware, Convertible Bed Mechanisms
3469	Metal Stampings, Not Elsewhere Classified	Wastebaskets, Stamped Metal
3495	Wire Springs	Furniture Springs, Spring Units for Seats
3499	Fabricated Metal Products, Not Elsewhere Classified	Metal Chair Frames, Metal Furniture Parts
3821	Laboratory Apparatus and Furniture	Laboratory Furniture, Benches, Tables, Cabinets
3843	Dental Equipment and Supplies	Dental Cabinets, Dentists' Chairs
3999	Manufacturing Industries, Not Elsewhere Classified	Beauty Shop and Barber Shop Furniture
7641	Reupholstery and Furniture Repair	Furniture Repair/Refinishing, Antique Repair Restoration

[a] These SIC code descriptions contain many other products that are outside the scope of the metal furniture source category and are not listed here. This table only includes the products that are considered to be within the scope of the metal furniture source category.

TABLE C-3. SIC CODES AND CORRESPONDING NAICS CODES

Category	1987 SIC Code	Equivalent 1997 NAICS Code	Equivalent 1997 NAICS Category
Metal Household Furniture	2514	337124	Metal Household Furniture Manufacturing
Office Furniture, Except Wood	2522	337214	Nonwood Office Furniture Manufacturing
Public Building and Related Furniture	2531	337127[a]	Institutional Furniture Manufacturing
Office and Store Fixtures, Partitions, Shelving, and Lockers, Except Wood	2542	337215	Showcase, Partition, Shelving, and Locker Manufacturing
Furniture and Fixtures, Not Elsewhere Classified	2599	(b)	Institutional Furniture Manufacturing
Hardware, Not Elsewhere Classified	3429	332510[c]	Hardware Manufacturing
Metal Stampings, Not Elsewhere Classified (Except Kitchen Utensils, Pots and Pans for Cooking and Coins)	3469	332116[d]	Metal Stamping
Wire Springs	3495	332612[e]	Wire Spring Manufacturing
Fabricated Metal Products, Not Elsewhere Classified	3499		Showcase, Partition, Shelving, and Locker Manufacturing
Residential Electric Lighting Fixtures	3645	335121	Residential Electric Lighting Fixture Manufacturing
Commercial, Industrial, and Institutional Electric Lighting Fixtures	3646	335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing
Laboratory Apparatus and Furniture	3821	339111	Laboratory Apparatus and Furniture Manufacturing

TABLE C-3. SIC CODES AND CORRESPONDING NAICS CODES (continued)

Category	1987 SIC Code	Equivalent 1997 NAICS Code	Equivalent 1997 NAICS Category
Dental Equipment and Supplies	3843	339114	Dental Equipment and Supplies Manufacturing
Manufacturing Industries, Not Elsewhere Classified	3999		Institutional Furniture Manufacturing
Reupholstery and Furniture Repair	7641		Reupholstery and Furniture Repair

[a] Includes 3371271, 3371274.

[b] Includes 3391137 and 3371277/A.

[c] Only includes 3325101.

[d] Only includes 3321165.

[e] Only includes 3326124.

TABLE C-4. ESTIMATED NATIONWIDE NUMBER OF METAL FURNITURE FACILITIES BY NAICS AND SIC CODE

NAICS Code	SIC Code	Description	Number of Facilities
337124	2514	Metal Household Furniture	163
337214	2522	Office Furniture, Except Wood	194
337127	2531	Public Building Furniture	150
337215	2542	Office and Store Fixtures, Partitions, Shelving, and Lockers, Except Wood	466
335121	3645	Residential Lighting Fixtures	245
335122	3646	Commercial and Industrial Lighting Fixtures	211
339113 and 337127	2599	Furniture and Fixtures, not elsewhere classified	303
332510	3429	Hardware, not elsewhere classified	59
332116	3469	Metal Stampings, not elsewhere classified	298
332612	3495	Wire Springs	180
339111	3821	Laboratory Apparatus and Furniture	384
339114	3843	Dental Equipment and Supplies	349
Total			3,002

Table C-5. Estimated Nationwide Number of Major and Area Sources in the Metal Furniture Industry

NAICS Code	SIC Code	Total Number of Facilities	Percent Major[a]	Nationwide Number of Facilities			
				Major Sources	Area Sources[b]	Percent Area Sources in Urban Areas	Area Sources in Urban Areas
337124	2514	163	44	72	91	51	46
337214	2522	194	43	83	111	44	49
337127	2531	150	25	38	112	22	25
337215	2542	466	38	177	289	38	110
335121	3645	245	23	56	189	85	161
335122	3646	211	16	33	178	62	110
339113 and 337127	2599	303	23	69	234	56	131
332510	3429	59	18	11	48	61	29
332116	3469	298	15	44	254	58	147
332612	3495	180	14	26	154	60	92
339111	3821	384	5	19	365	76	277
339114	3843	349	8	27	322	80	258
Total		3,002		655	2,347		1,435

[a] From TRI data.

[b] May include synthetic minor sources.

APPENDIX D

ESTIMATED EMISSION REDUCTION AND COST OF POWDER COATING

Estimated Emission Reduction and Cost of Powder Coating

Although not considered a technically feasible beyond-the-floor regulatory option for the entire metal furniture source category, there may be some sources that would chose to use powder coatings to reduce organic HAP emissions. Therefore, this appendix presents estimated organic HAP emission reductions achievable beyond the MACT floor level of control and the estimated cost to achieve these reductions.

A. Emission Reduction of Powder Coating

We observed through site visits and questionnaire responses that many metal furniture surface coating facilities use powder coatings for only a portion of their coating needs. Thus, we determined what portion of each model plant's production would have to be converted to powder coating, in conjunction with conversion to all non-HAP cleaning materials, to achieve an emission rate less than the existing source MACT floor. As shown in Table D-1, each model plant would have to convert all liquid coating usage to powder coating to achieve an emission rate that represented a level of control more stringent than that achieved by the MACT floor technology.

At 75 percent conversion to powder coatings, the emission rate for each of the model plants was approximately 0.09 kg HAP/L coating solids, which is at the low end of the emission rate range represented by low organic HAP content coatings. Each model plant would have to convert all liquid coating usage to powder coating to achieve a greater emission reduction than the existing source MACT floor. Therefore, the emission reduction and costs presented in this appendix represent that associated with complete conversion to powder coatings. We did not consider any level of conversion between 75 and 100 percent because the available cost data were not sufficiently refined to allow such an incremental analysis.

B. Powder Coating Cost Estimate

The capital cost of the powder coating line was based on the conversion of a liquid coating line to powder. By using only the conversion cost, we effectively accounted for the cost that would have been incurred for the liquid coating line. We also subtracted the cost of liquid coatings that would have been used by the facility, then added back the cost of an equivalent amount of powder coatings.

Cost information was obtained for the operation of a powder coating line from one metal furniture facility,[1] which was used to estimate the annual cost associated with powder coating for large model plants. Additional capital and annual cost information was obtained from a published case

[1] Confidential Business Information provided by a metal furniture manufacturer. July 1999.

study.[2] Since the coating solids usage for this case study facility was between that for the small and medium model plants, this information was used to estimate the capital costs for both of these model plant sizes.

For liquid coatings, a single average cost value was used which encompasses solventbased, waterbased, higher solids content, lower solids content, and a range of organic HAP content coatings. A single value was used for liquid coatings because of the wide range of coatings that are available. Since it was not possible to determine what mix of coatings may be used by any particular facility, an average liquid coating cost was determined to be the most accurate representation of this cost. Liquid coating costs obtained through published literature[3] were converted from cost per gallon to cost per liter coating solids. These values were then averaged to obtain the liquid coating cost used for this analysis ($12.05/L coating solids). This average value was then scaled to 1998 dollars using the Chemical Engineering Plant Cost Index.[4]

Similarly, the cost of powder coatings vary according to the supplier, volume purchased, and resin system, to name just a few factors. The metal furniture industry provided a range of costs for powder coatings, varying from about $7/kg to $26/kg. Again, since it was not possible to determine the mix of coatings used by a facility, we chose the midpoint of the range, $17/kg, as the most accurate representation of this cost.

For this analysis, it was assumed that the total coating solids used by a facility that uses powder coating application operations would decrease as compared to the coating solids used with liquid coating operations due to the ability to recycle the powder. Based on a published case study,[5] the amount of powder solids used was 31 percent less than the equivalent coating solids from liquid coatings.

Table D-2 presents the costs, additional organic HAP emission reduction, and cost per megagram of additional emission reduction for existing model plants for the regulatory alternative of conversion to powder coating. Table D-3 presents this same information for new model plants. For existing model plants, the cost per megagram of additional emission reduction ranged from $51,000 to

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[2] Pollution Prevention in Metal Painting and Coating Operations: A Manual for Pollution Prevention Technical Assistance Providers. The Northeast Waste Management Officials' Association. Boston, MA. 1998. p. 78.

[3] Bocchi, Gregory; Products Finishing, "Powder Coating Advantages," The Powder Coating Institute; June 1997.

[4] Chemical Engineering, Chemical Engineering Plant Cost Index, June 1998.

[5] Note 2.

$70,000 ($46,000 to $64,000 per ton). For new model plants, these costs ranged from $65,000 to $89,000 per megagram of additional organic HAP emission reduction ($59,000 to $81,000 per ton).

Table D-1. Organic HAP Emission Rates Estimated to be Achievable By Conversion to Thermal/IR Curable Powder Coating for Existing and New Metal Furniture Surface Coating Model Plants[a]

Model Plant	(A) Total Coating Solids Usage (L/yr)	(B) Total Organic HAP Emissions (kg/yr)	Amount of Liquid Coating Usage Converted to Powder Coating[b, c]							
			25 Percent		50 Percent		75 Percent		100 Percent	
			(C) HAP Emissions After Conversion[d] (kg/yr)	(D) Emission Rate[e] (kg HAP/L coating solids)	(E) HAP Emissions After Conversion[f] (kg/yr)	(F) Emission Rate[g] (kg HAP/L coating solids)	(G) HAP Emissions After Conversion[h] (kg/yr)	(H) Emission Rate[i] (kg HAP/L coating solids)	(I) HAP Emissions After Conversion[j] (kg/yr)	(J) Emission Rate[k] (kg HAP/L coating solids)
Small	22,000	7,500	5,600	0.255	3,800	0.173	1,900	0.086	0	0
Medium	54,000	19,600	14,700	0.272	9,800	0.181	4,900	0.091	0	0
Large	250,000	92,400	69,300	0.277	46,200	0.185	23,100	0.092	0	0

[a] Assumes that existing and new model plants would have the same coating solids usage and organic HAP emissions in the absence of a standard.
[b] HAP emissions after conversion to powder coatings assumes that there are no cure volatile emissions from the powder coatings.
[c] Emission rate after conversion assumes that the coating solids usage will not change.
[d] C = B x (100 - 25)/100
[e] D = C/A
[f] E = B x (100 - 50)/100
[g] F = E/A
[h] G = B x (100 - 75)/100
[i] H = G/A
[j] I = B x (100 - 100)/100

[k] J = I/A

Table D-2. Estimated Model Plant Cost per Megagram of Organic HAP Emission Reduction for Existing Metal Furniture Surface Coating Facilities for Conversion to Powder Coating

Model Plant	(A) Model Plant Coating Solids Usage[a] (L/yr)	(B) Model Plant Annual Costs[b] (1998 $)	(C) Model Plant Capital Costs[b] ($)	(D) Baseline Level of Control[c] (kg HAP/L coating solids used)	(E) Level of Control After Implementing Powder Coatings (kg HAP/L coating solids used)	(F) Additional Model Plant Organic HAP Emission Reduction[d] (Mg/yr)	(G) Model Plant Annual Cost per Mg of Additional Organic HAP Emission Reduction[e] ($/Mg)
Small	22,000	184,000	550,000	0.12	0	2.64	70,000
Medium	54,000	328,000	550,000	0.12	0	6.48	51,000
Large	250,000	1,674,000	3,350,000	0.12	0	30.0	56,000

[a]Source: Memorandum from Hendricks, D., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 14, 2001. Model Plants for the Metal Furniture Surface Coating Source Category.

[b] Annual and capital costs presented are the additional costs incurred beyond the baseline.

[c] The baseline is the MACT floor level of control. For details on the MACT floor, see: Memorandum from Hendricks, D., and Holmes, K., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 19, 2001. Recommended MACT Floors for Existing and New Major Sources for the Metal Furniture Surface Coating Source Category.

[d] F = (D - E) x A / 1,000

[e] G = B / F

Table D-3. Estimated Model Plant Cost per Megagram of Organic HAP Emission Reduction for New Metal Furniture Surface Coating Facilities for Conversion to Powder Coating

Model Plant	(A) Model Plant Coating Solids Usage[a] (L/yr)	(B) Model Plant Annual Costs[b] (1998 $)	(C) Model Plant Capital Costs[b] ($)	(D) Baseline Level of Control[c] (kg HAP/L coating solids used)	(E) Level of Control After Implementing Powder Coatings (kg HAP/L coating solids used)	(F) Additional Model Plant Organic HAP Emission Reduction[d] (Mg/yr)	(G) Model Plant Annual Cost per Mg of Additional Organic HAP Emission Reduction[e] ($/Mg)
Small	22,000	184,000	550,000	0.094	0	2.07	89,000
Medium	54,000	328,000	550,000	0.094	0	5.08	65,000
Large	250,000	1,674,000	3,350,000	0.094	0	23.5	71,000

[a]Source: Memorandum from Hendricks, D., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 14, 2001. Model Plants for the Metal Furniture Surface Coating Source Category.
[b] Annual and capital costs presented are the additional costs incurred beyond the baseline.
[c] The baseline is the MACT floor level of control. For details on the MACT floor, see: Memorandum from Hendricks, D., and Holmes, K., EC/R Inc., to Serageldin, M., EPA:ESD:CCPG. September 19, 2001. Recommended MACT Floors for Existing and New Major Sources for the Metal Furniture Surface Coating Source Category.
[d] F = (D - E) x A / 1,000
[e] G = B / F

APPENDIX E

DETAILED COST CALCULATIONS FOR PERMANENT TOTAL ENCLOSURES AND OXIDIZERS

Regenerative Thermal Oxidizer Cost Calculations

1. WASTE GAS HEAT CONTENT CALCULATED BASED ON UNCONTROLLED EMISSIONS AND EXHAUST FLOWRATE
2. PTE BASED ON LUKEY, SPOT A/C, ASSUMED DUCTWORK COSTS INCLUDED IN TOTAL CAPITAL COST SINCE UNITS ARE FIELD ERECTED.

TOTAL ANNUAL COST SPREADSHEET PROGRAM--REGENERATIVE THERMAL OXIDIZERS

FLOW <500,000 SCFM

COST BASE DATE: December 1988 [1]

VAPCCI (1998): [2] 108.8

INPUT PARAMETERS			
MODEL PLANT	Large	Medium	Small
-- Gas flowrate (scfm):	200000	100000	100000
-- Reference temperature (oF):	77	77	77
-- Inlet gas temperature (oF):	100	100	100
-- Inlet gas density (lb/scf):	0.0739	0.0739	0.0739
-- Primary heat recovery (fraction):	0.95	0.95	0.95
-- Waste gas heat content (BTU/scf):	0.030	0.030	0.030
-- Waste gas heat content (BTU/lb):	0.41	0.41	0.41
-- Gas heat capacity (BTU/lb-oF):	0.255	0.255	0.255
-- Combustion temperature (oF):	1600	1600	1600
-- Heat loss (fraction):	0.01	0.01	0.01
-- Exit temperature (oF):	175	175	175
-- Fuel heat of combustion (BTU/lb):	21502	21502	21502
-- Fuel density (lb/ft3):	0.0408	0.0408	0.0408
DESIGN PARAMETERS			
Auxiliary Fuel Requirement (lb/min):	15.558	7.779	7.779
(scfm):	381.3	190.7	190.7
Total Gas Flowrate (scfm):	200381	100191	100191
TOTAL CAPITAL COST ($) [3]			
(Cost correlations range: 5000 to 500,000 scfm)			
@ 85 % heat recovery--base:	0	0	0
' ' ' --escalated:	0	0	0
@ 95 % heat recovery--base:	5,149,540	2,853,170	2,853,170
' ' ' --escalated:	6,127,576	3,395,063	3,395,063
PERMANENT TOTAL ENCLOSURE	216,000	117,300	117,300
TOTAL CAP COST ($)	6,343,576	3,512,363	3,512,363

Regenerative Thermal Oxidizer Cost Calculations

ANNUAL COST INPUTS			
Operating factor (hr/yr):	6600	6600	6600
Operating labor rate ($/hr):	37.61	37.61	37.61
Maintenance labor rate ($/hr):	41.37	41.37	41.37
Operating labor factor (hr/sh):	1	1	1
Maintenance labor factor (hr/wk):	1	1	1
Electricity price ($/kwh):	0.05	0.05	0.05
Natural gas price ($/mscf):	3.10	3.10	3.10
Annual interest rate (fraction):	0.07	0.07	0.07
Oxidizer control system life (years):	10	10	10
Oxidizer capital recovery factor:	0.1424	0.1424	0.1424
Permanent total enclosure control system life (years):	30	30	30
Permanent total enclosure capital recovery factor:	0.0806	0.0806	0.0806
Taxes, insurance, admin. factor:	0.04	0.04	0.04
Pressure drop (in. w.c.):	20.0	20.0	20.0

ANNUAL COSTS

Item		Cost ($/yr)	Cost ($/yr)	Cost ($/yr)

Operating labor		15,515	15,515	15,515
Supervisory labor		2,327	2,327	2,327
Maintenance labor		2,151	2,151	2,151
Maintenance materials		2,151	2,151	2,151
Natural gas		467,966	233,983	233,983
Electricity		232,617	116,309	116,309
Overhead		13,287	13,287	13,287
Taxes, insurance, administrative		253,743	140,495	140,495
Oxidizer capital recovery		872,429	483,381	483,381
Permanent total enclosure capital recovery		17,407	9,453	9,453
Permanent total enclosure related electricity cost		87,232	43,616	43,616

Total Annual Cost		$1,966,826	$1,062,667	$1,062,667
	Indirect Cost	$1,156,865	$646,615	$646,615
	Direct Cost	$809,960	$416,052	$416,052

[1] Base total capital investment reflects this date.
[2] VAPCCI = Vatavuk Air Pollution Control Cost Index (for regenerative thermal oxidizers) corresponding to year and quarter shown. Base total capital investment has been escalated to this date via VAPCCI and control equipment vendor data. Available at: http://www.epa.gov/ttn/catc/products.html#cccinfo
[3] Source: Vatavuk, William M. ESTIMATING COSTS OF AIR POLLUTION CONTROL. Boca Raton, FL: Lewis Publishers, 1990.

Assumptions:

1) Monitoring and recordkeeping costs are not included
2) Permanent total enclosure (PTE) costs estimated based on case studies by M. Lukey, PES, and engineering judgement.
3) Permanent total enclosure costs assume engineering = 10% PTE cost; spot air conditioning, 30 year life.
4) Because regenerative thermal incinerators are field erected, it is assumed that ductwork costs are included in the Total Capital Cost estimate.
5) Electricity cost $0.0451/kwh, natural gas cost $3.099/mscf, both based on information from Energy Information Administration for 1998.
6) Operator labor rate = 17.91/hr*1.67=$29.91/hr, maintenance labor rate = 1.1*operator rate =$32.90/hr.
Both were based on Bureau of Labor Statistics data for March 1999.

Revised on 11/9/00, 9/26/01. 10/5/01

Regenerative Thermal Oxidizer Cost Calculations

Calculate waste gas heat contents for each of the model plants

Calculation based on average uncontrolled emission rate for each model plant in kg HAP/l solids (See MF-MACTFLOORREV16)

Assumes HAP is xylene with heat of combustion (Btu/lb) = 17559

Annual Operating hours= 6600

Model Plant	Exhaust Flowrate (scfm)	Unctrl Emissions (tpy)	Unctrl Emissions (lb/min)	Gas stream ht of combustion (Btu/scf)	Corresponding Conc. (ppm)
Small	100,000	4.844101295	0.0245	0.0043	1
Medium	100,000	11.711492595	0.0591	0.0104	2
Large	200,000	67.557824125	0.3412	0.0300	6

Gas stream heat of combustion (Btu/scf) = [unctrl. emiss. (lb/min)]*[xylene ht. of combustion (Btu/lb)]/exhaust flowrate (scfm)

Concentration (ppm) ={[unctrl. emissions (lb/min)]*[397 ft3 xylene/lb mole xylene]/[106.16 lb xylene/lb mole xylene]}*{[1000000/exhaust(scfm)]}

Small, Medium, and Large model plants - assumes that all emissions/lines vented to control device

Permanent Total Enclosure Cost Calculations

PERMANENT TOTAL ENCLOSURE (PTE) CAPITAL COSTS

AWMA-based capital A/C cost, 30 yr life

Base PTE Cost	$50,000		Spot A/C Factor	0.00125
Base Room Volume (KFT3)		270		

Model Plant	Room Vol. (KFT3)	Calc. PTE Cost ($)	(A) PTE Cost to Use [1] ($)	(B) Engineering Cost ($)	Exhaust (scfm)	A/C Capacity Needed (tons)	Calc. A/C Capital Cost ($)	AWMA-based A/C Capital Cost ($)	(C) A/C Capital Cost to Use [1] ($)	A/C Electrical Use (kW)	Total PTE Capital Cost (A+B+C) ($)
Small	180	$33,333	$33,000	$3,300	100,000	125	$150,000	$81,031	$81,000	147	$117,300
Medium	180	$33,333	$33,000	$3,300	100,000	125	$150,000	$81,031	$81,000	147	$117,300
Large	270	$50,000	$50,000	$5,000	200,000	250	$300,000	$160,831	$161,000	293	$216,000

[1] - "to use" refers to the values used to determine the total capital cost and reflect the significant figures in the calculated values.

Assumptions:

- Room Volume based on information obtained from industry surveys and scaled by model plant coating lines
- Base PTE Cost based on case studies by M. Lukey, PES, and engineering judgement
- PTE costs of model plants based on estimated size of the enclosure, and engineering judgement
- Engineering cost estimated as 10% of PTE cost
- A/C calculations assume spot air conditioning is installed
- A/C capacity based on cost factors presented by M. Lukey, PES, as 25 tons/20,000 scfm

-A/C cost based on cost factors presented by M. Lukey, PES, as $30,000 per 25 tons

-AWMA A/C cost estimated using formulas in AWMA Lukey/EPA PTE costing spreadsheet

-Electricity required for calculated A/C capacity calculated using equation presented in "Mechanical Engineering Reference Manual", M. Lindeburg, 8th Edition. 1990. Page 7-28.

Small - represents 2 coating lines at 180 kft3

Medium - represents 2 coating lines at 180 kft3

Large - represents 4 coating lines at 270 kft3

Permanent Total Enclosure Cost Calculations

MAKEUP AIR FAN COST

From AWMA spreadsheet, the makeup air fan cost was $5,733 for an air flow rate of 26,200 scfm. This cost was scaled by the ratio of the calculated makeup air flow rate from "Makeup Air Flowrate" and the AWMA air flow rate (87,333/26,200).

Model Plant	Total Exhaust (scfm)	Calc'd Makeup Air Flow from "Makeup Air Flowrate" (scfm)	Scaled Makeup Fan Cost ($)
Large	200,000	174,667	38,220
Medium	100,000	87,333	19,110
Small	100,000	87,333	19,110

SPOT AIR CONDITIONING COST

Will assume spot air conditioning is needed.

Spot air conditioning refers to the use of small air conditioning units placed where needed, rather than central air conditioning for the entire enclosure.

Note: AWMA example assumed that no A/C was needed. However, formulas in the spreadsheet were used to calculate the materials and installation costs for both total and spot A/C

Formulas for spot vs total A/C apply different multipliers to (scfm), so assume scfm to be entered is TOTAL EXHAUST and not just the amt. of exhaust cooled by spot A/C

Spreadsheet formula spot A/C:

	Materials ($)	(987 + (0.693*scfm))
	Installation ($)	(244 + (0.105*scfm))

Model Plant	Total Exhaust (scfm)	Spot A/C material Cost ($)	Spot A/C Installation Cost ($)	Spot A/C Total Cost ($)	Spot A/C capacity (tons)
Large	200,000	139,587	21,244	160,831	250
Medium	100,000	70,287	10,744	81,031	125
Small	100,000	70,287	10,744	81,031	125

(Spot A/C capacity from ptemr&r.wk4)

MAKEUP AIR FLOWRATE

The electricity associated with operation of the makeup air fan was calculatedtaking the following factors into account:
1. The electricity usage is a function of makeup air flowrate.
2. Because we do not have makeup air flowrates and they cannot easily be calculated, they were estimated for electricity usage purposes by applying the ratio of makeup airflow to total exhaust flow from the example in the AWMA spreadsheet.
3. All other makeup air fan electricity usage related parameters from AWMA spreadsheet were used (press. drop, etc.)

Ratio of makeup airflow to total exhaust from AWMA spreadsheet: (26,200/30,000) = 0.87

Model Plant	Total Exhaust	Calc'd Makeup Air flowrate
	(scfm)	(scfm)
Large	200,000	174,667
Medium	100,000	87,333
Small	100,000	87,333

Permanent Total Enclosure Cost Calculations

ANNUAL COSTS ASSOCIATED WITH INSTALLATION AND OPERATION OF PERMANENT TOTAL ENCLOSURE (PTE)

MODEL PLANT		Small	Medium	Large
TOTAL CAPITAL INVEST.		$117,300	$117,300	$216,000

ANNUAL COST INPUTS

Operating hours per year	6600
Electricity price ($/kwh):	0.05
Annual interest rate (fraction):	0.07
PTE system life (years):	30
Capital recovery factor:	0.0806

ANNUAL COSTS (1998$)

Item	Cost ($/yr)		
Electricity	43,616	43,616	87,232
Capital recovery	9,453	9,453	17,407
Total Annual Cost	53,069	53,069	104,639

Assumptions:

1) Base PTE Cost based on case studies by M. Lukey, PES, and engineering judgement
2) PTE costs of model plants based on estimated size of the enclosure, and engineering judgement
3) Engineering cost estimated as 10% of PTE cost
4) AC calculations assumespot air conditioning is installed
5) AC capacity based on cost factors presented by M. Lukey, PES, as 25 tons/20,000 scfm
6) AC cost based on equations in AWMA Lukey/EPA paper and assoc. spreadsheet
7) Electricity required for calculated AC capacity calculated using equation presented in "Mechanical Engineering Reference Manual", M. Lindeburg, 8th Edition. 1990. Page 7-28.
8) Capital recovery based on a 30 year equipment life based on AWMA Lukey/EPA paper
9) Electricity cost $0.0451/kwh, based on info. from Energy Information Administration for 1998

APPENDIX F

CALCULATION METHODOLOGY FOR THE AFFECTED-SOURCE-WIDE EMISSION RATE USED TO DETERMINE THE METAL FURNITURE NESHAP MACT FLOOR IN CHAPTER 6

Calculation Methodology for the Affected-source-wide Emission Rate

This example is based on the materials used by a hypothetical facility as presented in the spreadsheet below. Refer to this spreadsheet for the explanations that follow.

A. HAP Emissions from Each Material

HAP emissions were calculated by multiplying material usage (in liters) by the density (in kg/liter) to obtain the mass of the material used. This value was then multiplied by the HAP content (as a decimal) to obtain the mass of HAP in the material used. In the example spreadsheet for a hypothetical facility (below) for Material #1, the emissions of 2-butoxyethanol is (51,200 L) x (1.11 kg/L) x (12/100) = 6,820 kg. This procedure was repeated for each HAP component of each material.

B. Coating Solids Volume

Coating solids volume was calculated by multiplying the coating usage (in liters) by the coating solids content in percent by volume (as a decimal). In the attached example for Material #1, the coating solids volume is (51,200 L) x (32/100) = 16,384 L. This procedure was repeated for each coating material. Note that Material #5 is a thinning solvent and contains no coating solids.

C. Total HAP Emissions

Total HAP emissions were calculated as the sum of the HAP emissions from each material component. In the attached example, total HAP emissions are the sum of Column E, which is 17,346 kg.

D. Total Coating Solids Volume

Total coating solids volume was calculated as the sum of the coating solids volume from each coating material. In the attached example, total coating solids volume is the sum of Column G, which is 25,513.

E. Normalized Facility Emissions

Normalized facility emissions were calculated as the total HAP emissions divided by the total coating solids volume. In the attached example, the normalized facility emissions are
(17,346 kg HAP)/(25,513 L coating solids) = 0.68 kg HAP/L coating solids.

Example Spreadsheet for the Affected-source-wide Emission Rate Calculation Methodology

XYZ Company

Facility ID	Material ID	Usage (L) (A)	Material Density (Kg/L) (B)	HAP Component (C)	HAP Content (Mass %) (D)	HAP Emissions (Kg) (E) (see note a)	Coating Solids Content (Vol %) (F)	Coating Solids Volume (L) (G) (see note b)
MFX-01	1	51,200.00	1.11	2-Butoxyethanol	12.00	6819.84	32.00	16384.00
		51,200.00	1.11	Formaldehyde	0.10	56.83		
	2	19,235.00	1.03	2-Butoxyethanol	6.00	1188.72	28.20	5424.27
		19,235.00	1.03	Formaldehyde	0.02	4.16		
		19,235.00	1.03	Ethylbenzene	0.02	4.16		
	3	2,341.00	0.99	2-Butoxyethanol	5.00	115.88	21.30	498.63
	4	9,658.00	0.96	Xylene	27.00	2503.35	33.20	3206.46
		9,658.00	0.96	Naphtha (see note c)	0.05	4.64		
	5	7,642.00	0.87	2-Butoxyethanol	100.00	6648.54	0.00	0.00

Total HAP Emissions (Kg) (H) (see note d)	Total Coating Solids Volume (L) (I) (see note e)	Normalized Facility Emissions (Kg HAP/L Coating Solids) (J) (see note f)
17346.13	25513.36	0.68

(a) HAP Emissions (E) = (A)*(B)*((D)/100)

(b) Coating Solids Volume (G) = (A)*(F/100)

(c) Solvent blend for Naphtha was assigned 1% HAP by mass. HAP content values were taken from information provided by the Chemical Manufacturer's Association Solvent Council, and were used only when the solvent blend HAP content was reported to be zero.

(d) Total HAP Emissions (H) = Sum of Column (E)

(e) Total Coating Solids Volume (I) = Sum of Column (G)

(f) Normalized Facility Emissions (J) = (H)/(I)

APPENDIX G

SUMMARY OF DATA FOR EPA SAMPLED COMPANIES OPERATING METAL FURNITURE MANUFACTURING FACILITIES

Appendix G. Summary Data for EPA Sampled Companies Operating Metal Furniture Manufacturing Facilities

			No. of Facilities		
Company Name	Sales ($$10^6$)	Employment	Total	Major Source	Small Business
Arrowhead Holdings Corporation	$165.50	1,990	3	3	No
Atlas Springs Manufacturing Corporation	$9.40	140	1	1	Yes
B-Line Systems	$223.50	1,400	1	1	No
Crown Metal Manufacturing Company	$13.00	125	1	0	Yes
Davies Office Refurbishing, Inc.	$2.50	200	1	1	Yes
Dehler Manufacturing Company, Inc.	$10.00	120	1	0	Yes
Den-Tal-Ez, Inc.	$23.10	327	1	1	Yes
Genlyte Group Incorporated	$664.10	3,490	1	1	No
Hickory Springs Manufacturing Company	$23.10	295	2	2	Yes
HON Industries	$1,696.40	9,824	7	4	No
Kimball International	$1,107.00	9,556	2	2	No
Leggett & Platt Incorporated	$3,370.40	27,000	10	10	No
Lozier Corporation	$281.10	2,400	3	3	No
L.A. Darling Company, Inc.	$300.00	3,000	2	2	No
Metal Creations	$37.00	NA	1	1	Yes
Mid-West Chandelier Company	$17.80	NA	1	1	Yes
National Service Industries, Inc.	$2,031.30	16,700	7	1	No
Nevin Laboratories, Inc.	NA	NA	1	0	No
Professional Refinishing Organization	$2.20	58	1	1	Yes
Republic Storage Systems, Inc.	$52.00	450	1	1	Yes
Siemens Medical System, Inc.	$11,144.00	57,950	1	1	No
Standex International Corporation	$616.20	5,500	1	1	No
Steelcase Incorporated	$2,742.50	16,400	11	11	No
Virco Manufacturing Corporation	$273.60	2,373	1	1	No
			62	49	10

TECHNICAL REPORT DATA

(Please read Instructions on reverse before completing)

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16. ABSTRACT

A draft rule for the regulation of hazardous air pollutants (HAP) from metal furniture coating operations is being proposed under the authority of Section 112(d) of the Clean Air Act. This document contains comments the background information used to develop the draft rule.

17. KEY WORDS AND DOCUMENT ANALYSIS

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