PRELIMINARY INDUSTRY CHARACTERIZATION:

SURFACE COATING OF METAL FURNITURE

Coatings and Consumer Products Group
Emission Standards Division (MD-13)
Office of Air Quality Planning and Standards

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Preliminary Industry Characterization:
Surface Coating of Metal Furniture

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I. OVERVIEW OF INITIAL PHASE AND NEXT STEPS FOR MACT DEVELOPMENT

Under Section 112(d) of the Clean Air Act (the Act), the U.S. Environmental Protection Agency (EPA) is developing national emission standards for hazardous air pollutants (NESHAP) for the metal furniture surface coating source category. The EPA is required to publish final emission standards for the metal furniture source category by November 15, 2000. For this category, national volatile organic compound (VOC) rules or control techniques guidelines under Section 183(e) are being developed on a similar schedule.

The Act 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 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 achieve by the best performing 5 sources. The NESHAP are commonly known as maximum achievable control technology (MACT) standards.

The MACT standards development for the metal furniture industry began with a Coating Regulations Workshop for representatives of EPA and interested stakeholders in April 1997 and continues as a coordinated effort to promote consistency and joint resolution of issues common across nine coating source categories.[1] During this first phase EPA gathered readily available information about the industry with the help of representatives from the regulated industry, State and local air pollution 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
- Identify the range(s) of emission reduction techniques and their effectiveness
- Make an initial determination on the scope of each category
- Determine the relationships and overlaps of the 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 plan for addressing them
- Develop questionnaire(s) for additional data gathering and
- Document results of the first phase of regulatory development for each category.

[1] 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 industry members that participated in the stakeholder process were members of both the American Furniture Manufacturers Association (AFMA) and the Business and Institutional Furniture Manufacturers Association (BIFMA), as well as independent industry representatives. The States that participated in the process were Alabama, California, Florida, Georgia, Illinois, Indiana, Kansas, Pennsylvania, and Tennessee. The South Coast Air Quality Management District (AQMD) (California), Bay Area AQMD (California), Ventura County Air Pollution Control District (APCD) (California), San Joaquin Valley Unified APCD (California), Placer County APCD (California), Sacramento APCD (California), Mojave Desert-Antelope Valley AQMD (California), and the Chattanooga/Hamilton County Air Pollution Control Bureau (Tennessee) also participated. The U.S. EPA was represented by the Office of Air Quality Planning and Standards (EPA/OAQPS); the Office of Prevention, Pesticides, and Toxic Substances (EPA/OPPTS); the Office of Enforcement and Compliance Assurance (EPA/OECA); and the Office of Small and Disadvantaged Business Utilization (OSDBU). Appendix A contains a list of stakeholders who have participated in the initial phase of the rule development project.

The information summarized in this document can be used by States that may have to make case-by-case MACT determinations under Sections 112(g) or 112(j) of the Act. The initial phase of the regulatory development focused primarily on metal furniture cleaning operations prior to coating application and coating application and curing systems. This memorandum represents the conclusion of that phase of rule development.

This document includes a description of the emission control technologies identified by the EPA that are currently used in practice by the industry and that could serve as the basis of MACT. However, only limited data were collected within the short time frame intended for this initial phase. The information summarized in this memorandum was collected prior to August 1, 1998. Additional information will be collected and considered before the surface coating of metal furniture standards are promulgated.

During the next phase, EPA will continue to build on the knowledge gained to date and proceed with more focused investigation and data analyses. We will also continue our efforts to coordinate cross-cutting issues. We will continue to identify technical and policy issues that need to be addressed in the rule making and enlist the help of the stakeholders in resolving those issues.

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II. SUMMARY OF INITIAL PHASE OF MACT DEVELOPMENT

Background

Section 112 of the Clean Air Act (CAA) mandates that the EPA promulgate national emission standards for hazardous air pollutants on a strict schedule. The CAA mandates that the standards for each source category require sources to implement MACT to reduce emissions of HAP.

The MACT standard for the Surface Coating of Metal Furniture source category is scheduled for promulgation by November 2000. If the EPA fails to meet this deadline by more than 18 months, Section 112(j) of the CAA includes a "hammer" provision requiring that operating permits for major sources contain HAP emission limitations determined to be equivalent to MACT. The equivalency determinations are to be made on a case-by-case basis for individual sources.

Section 112(g) requires case-by-case MACT determinations for sources where no applicable emission limitations have been established. The final 112(g) regulation governing case-by-case MACT determinations for constructed or reconstructed sources was published in the Federal Register on December 27, 1996 (61 FR 68384). This regulation requires case-by-case MACT for new and reconstructed major sources to be consistent with "new source MACT" (i.e., no less stringent than the emission control that is achieved in practice by the best controlled similar source).

Definitions

Definitions for common terms used in this document are included in Appendix A.

Summary of Information Gathering

Preliminary information on sources of HAP and VOC in the metal furniture manufacturing industry was compiled through information requested from States, Section 114 questionnaires, site visits to facilities that produce metal furniture, and a review of related Federal and State regulations.

In order to begin the task of characterizing the industry and to provide a basis from which data could be requested from States, a list of products relevant to the metal furniture industry was developed. After a list of relevant products was developed, their corresponding Standard Industrial Classification (SIC) codes and North American Industry Classification System (NAICS) codes were identified and used to simplify data gathering. The SIC and NAICS codes were divided into two groups: metal furniture manufacturing codes that dealt almost exclusively with metal furniture products, and SIC codes related to metal furniture that only partially encompassed metal furniture products. Appendix D, Table D-1 lists the metal furniture products groups and

manufacturing SIC codes. The SIC codes related to metal furniture and their associated relevant products are listed in Appendix D, Table D-2. Appendix D, Table D-3 lists the metal furniture product descriptions and manufacturing SIC codes and the SIC codes related to metal furniture manufacturing and their corresponding NAICS codes.[2]

Information Requested from States

An inventory of the States with the greatest number of metal furniture manufacturing facilities was generated through the Toxic Release Inventory System (TRIS) and the American Business Index Database. Each of these sources was searched by SIC code. Only the metal furniture manufacturing SIC codes listed in Appendix D, Table D-1 were used for the search due to the difficulty in determining which facilities in the SIC codes related to metal furniture manufacturing produce products applicable to the metal furniture source category. Tables II-1 and II-2 list the States with the greatest number of metal furniture manufacturing facilities as determined from the TRIS and American Business Index databases, respectively. The air pollution control agencies in each of these states received a request for available information on facilities within both the metal furniture and related SIC codes. Copies of state emissions inventories, facility Title V permit applications, Reasonably Available Control Technology (RACT) information, Best Available Control Technology (BACT) information, and Lowest Achievable Emission Rate (LAER) information were requested. States that provided information to the EPA and a summary of the type of information contributed are detailed in Table II-3.

Initial Industry Surveys

Eight companies were selected to receive the initial questionnaires in June 1997, under the authority of Section 114 of the CAA for the purpose of compiling detailed information on quantities of HAP and VOC emissions and the status of current emission control techniques. The 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.

As a means of identifying and quantifying the possible sources of pollution, information was collected on the basis of the Unit Operation System (UOS).[3] A plant (or facility) is

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[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] "Standardized Accounting for a Formal Environmental Management and Auditing System," Chapter 20 in Waste Minimization Through Process Design, A.P. Rossiter, ed., McGraw-Hill, Inc. 1995.

TABLE II-1. TOP 12 STATES BY NUMBER OF FACILITIES IN THE METAL FURNITURE MANUFACTURING SIC CODES - 1995 TRIS DATA[a]

State	Number of Facilities
Pennsylvania	16
Michigan	14
Tennessee	10
California	9
Wisconsin	9
Indiana	8
Alabama	7
Kansas	7
New York	7
Mississippi	6
North Carolina	6
Ohio	6

[a] Information derived from 1995 Toxic Release Inventory System (TRIS) data.

TABLE II-2. TOP 10 STATES BY NUMBER OF FACILITIES IN THE METAL FURNITURE MANUFACTURING SIC CODES - AMERICAN BUSINESS INDEX DATA[a]

State	Number of Facilities
California	420
Michigan	294
New York	269
Florida	256
Illinois	235
Indiana	191
Texas	189
Missouri	161
Ohio	154
Pennsylvania	147

[a] Information derived from American Business Index Database; American Business Information Incorporated; Omaha, Nebraska.

TABLE II-3. 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

considered to consist of several levels of production activity, consisting of departments, which are divided into work areas, which in turn are composed of one or more unit operation systems. The term UOS refers to a formalized concept for performing a material balance. A UOS is the ensemble on which the material balance is performed. A UOS includes all possible points/sources that could result in emissions of HAP to the atmosphere as a result of the operations considered within the boundary of the UOS (see Figures II-1, II-2, and II-3). As illustrated in Figure II-3, the total mass of HAP materials entering the UOS boundary equals the mass of HAP materials in the emissions and in the coating waste stream. Facilities do not need to estimate emissions at each of the UOS operations (Coating Application, Flash-off, and Oven) in order to calculate total emissions. Using the material balance approach, total emissions can be calculated if the HAP content of the input coatings and exiting waste streams are known. The June 1997 Section 114 questionnaire used the UOS as the basis for which data were to be reported.

Various methods were used to select the recipients of the questionnaire, with the desired result being a broad cross-section of the industry. Four companies under SIC code 2522 (office furniture, except wood) received Section 114 questionnaires as a result of their position as leading manufacturers of office furniture. Through discussions with the National Association of Store Fixture Manufacturers (NASFM) and the appearance of store fixture manufacturing companies on a TRIS report, two store fixture manufacturing companies (SIC code 2542) were identified to receive the questionnaire. A product search was performed on the Dental Manufacturers of America (DMA) website (http://www.dmanews.org) 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 questionnaire.

Additional Section 114 questionnaires were sent in June 1998. Responses from survey recipients are expected by August 24, 1998. The following metal furniture industry segments were surveyed: household, office, and public building furniture and store fixtures, partitions, and shelving manufacturing companies; residential and commercial lighting fixtures manufacturing companies; laboratory and dental furniture manufacturing companies; furniture repair operation companies; metal furniture parts and hardware manufacturing companies; and miscellaneous metal furniture products manufacturing companies.

Site Visits

Nine separate facilities were visited by the EPA during the initial phase, covering a variety of relevant products (see Table II-4). These facilities ranged from a small plant with less than 100 employees to a major manufacturing facility with over 1000 employees.

TABLE II-4. METAL FURNITURE SITE VISITS

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

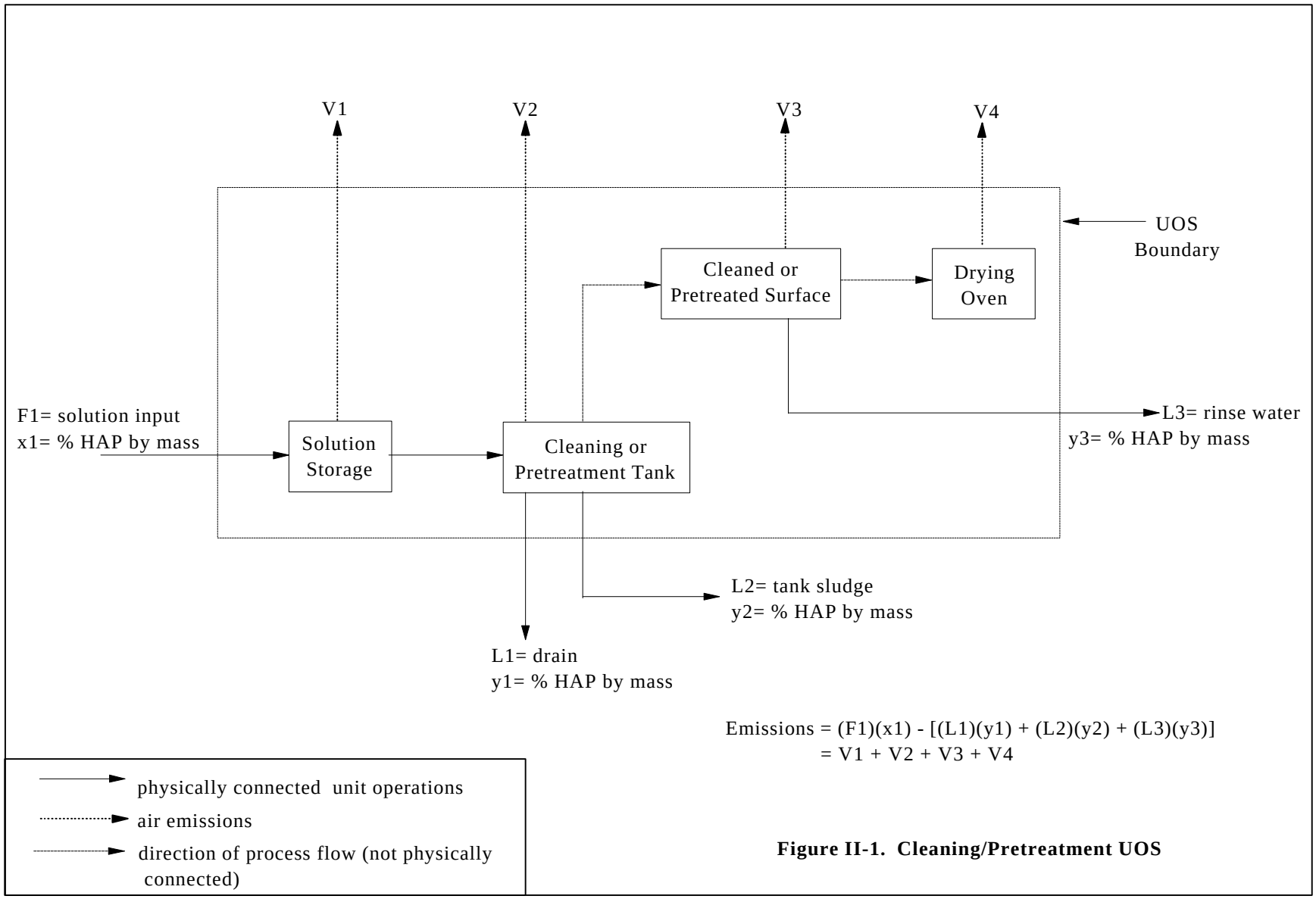
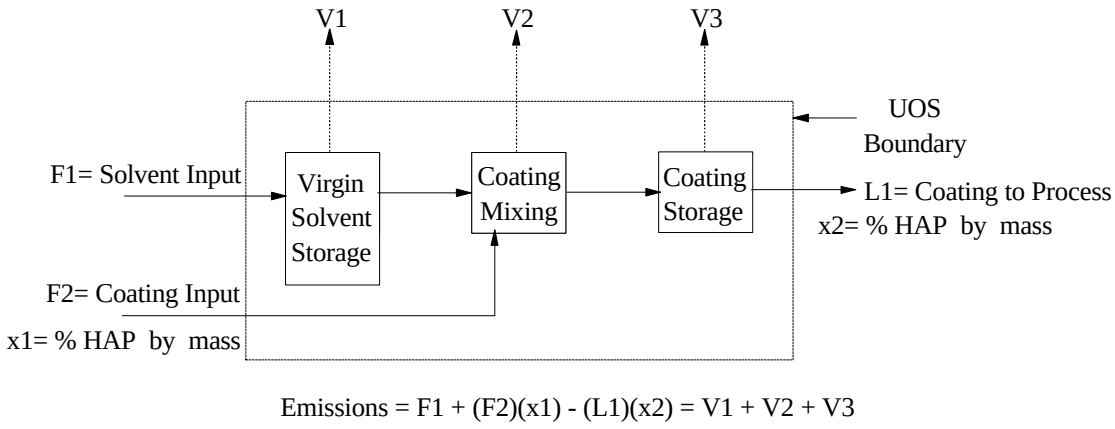
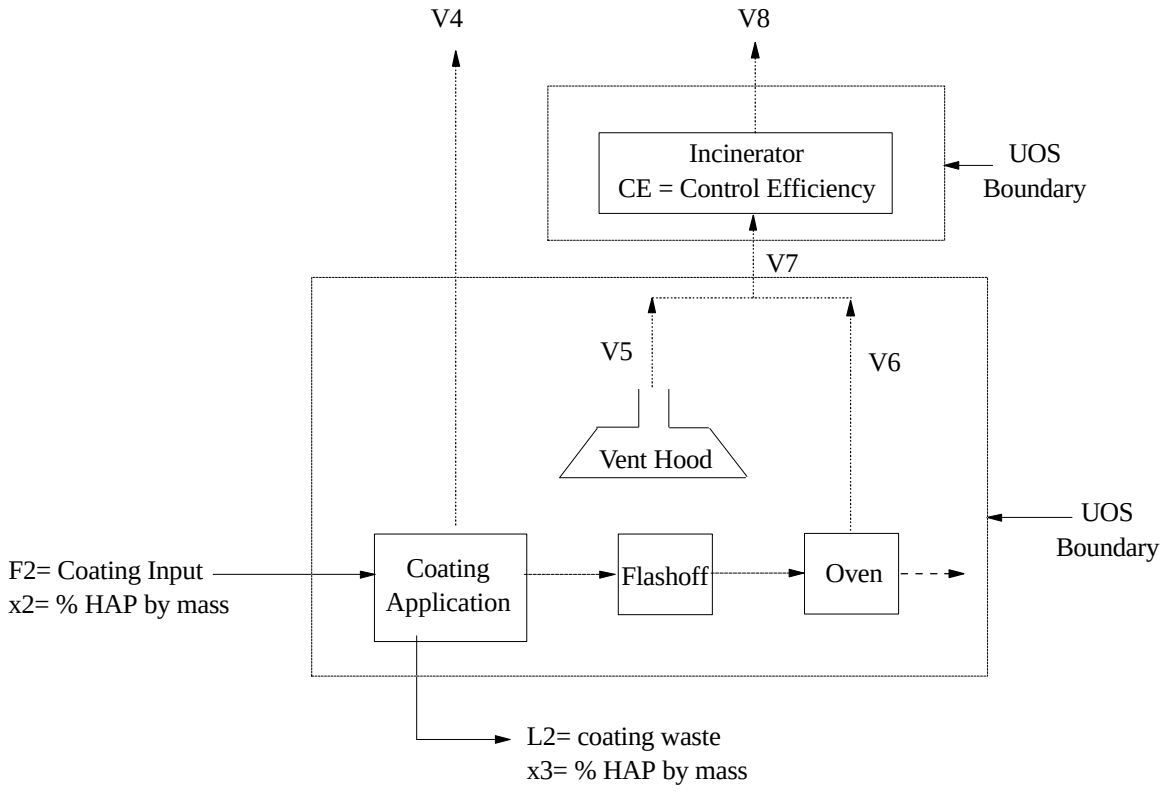


Figure II-1. Cleaning/Pretreatment UOS



Emissions = F1 + (F2)(x1) - (L1)(x2) = V1 + V2 + V3

Figure II-2. Coating Mixing and Storage UOS (Primer or Topcoat)



Emissions = (F2)(x2) - (L2)(x3) = V4 + V7

Total Emissions = V4 + V8 = V4 + (V7)(1-CE)

physically connected unit operations

air emissions

direction of process flow (not physically connected)

Figure II-3. Coating Application/Drying UOS
(Primer or Topcoat)

Site visits to metal furniture manufacturing facilities were performed for the purpose of obtaining information on the following:

- Description of the plant itself--size, hours of operation, layout of production lines, types of unit operations, types and market position of finished products, and production rates;

- Detailed descriptions of the metal furniture manufacturing operations and the chemicals used;

- Descriptions of any pollution prevention techniques employed, such as modifications to a unit operation for source reduction or add-on control devices used to limit or destroy HAP emissions from the operations; and

- Available cost information concerning HAP emission reduction strategies being employed.

Particular attention was given to cleaning operations prior to coating application and coating application and curing systems because they were expected to contribute a large percentage of HAP emissions from metal furniture manufacturing facilities. A general discussion of cleaning operations and coating application and curing systems is provided in Section III.

Roundtable Meetings

An initial kickoff to the P-MACT phase of the project was held on April 9, 1997, at the U.S. EPA Coating Regulations Workshop Metal Furniture/Large Appliance Breakout Session held in Durham, NC. This meeting addressed the standards development process and identified preliminary concerns of the Workshop participants. A series of on-going roundtable meetings followed.

The first stakeholder roundtable meeting for metal furniture was attended by State, EPA, and industry representatives on May 28, 1997, to identify data sources for the collection of information about the industry, review the regulatory development process with industry and raise issues of concern to all parties, coordinate regulatory development efforts and scheduling with industry representatives, and to discuss potential data sources and action items for participants.

A summary of the initial questionnaire results and information received from State/local air pollution control agencies (including RACT/BACT/LAER information, state emissions inventories, and Title V permit applications) was presented at the second roundtable meeting on July 31, 1997. A discussion of the data and possible formats for the collection and evaluation of data took place. Industry representatives also expressed concern primarily over two issues: 1) the benefit of using the UOS as the basis of data gathering efforts rather than more traditional methods used by the EPA in the past, and 2) the validity of analyzing coating emissions on a

surface area basis (or any other basis) rather than on a coating content basis as has been used by the EPA in the past.

A third roundtable meeting with industry representatives was held on March 19, 1998. The major focus of the meeting was to discuss the next data gathering phase of the project and the associated draft Section 114 questionnaire. Several industry representatives were concerned that detailed operation-specific information requested in the draft questionnaire submitted for review in March 1998 may not be available and only facility-wide information will be reported. The EPA stressed that the flexibility of the final rule will be limited if information is gathered on only a facility-wide basis. Meeting minutes for the EPA roundtable meetings may be obtained from the EPA's Internet site at http://www.epa.gov/ttn/uatw/coat/mfurn/met_furn.html.

Data Analysis

From the information received in the initial questionnaires, as well as other data gathering efforts, an initial industry profile and descriptions of operations were developed (see Section III). Operations that are potential sources of HAP emissions were identified, including metal working (stamping, bending, forming, welding); electrolytic plating; cleaning (parts cleaning before coating application, spray gun cleaning, spray booth cleaning); paint application and curing/drying; touch-up and repair; storage, handling, and mixing of solvents and coatings; and wastewater treatment. To enhance the preliminary industry profile, analyses of several databases (e.g., TRIS database and the American Business Disk database) were performed to determine information on geographic location of metal furniture facilities, number of facilities and employees associated with each SIC code identified as containing metal furniture products, and specific HAP emissions associated with point and non-point sources.

A database of coating lines was developed from the information received in the initial questionnaires. Responses were received from 16 facilities representing 46 coating lines. The coating lines were evaluated by coating application method. This analysis showed that 82 percent of the lines applied coating using spray guns (56 percent were liquid coating, 26 percent were powder coating). Another 13 percent applied adhesive coating, 2 percent were electrocoat operations, and 2 percent were electrolytic plating operations (see Figure III-2 for a breakdown of the number of coating lines by coating type and application method). Each coating type was further evaluated by coating usage, surface area coated, and VOC material emission rate.

Data Limitations

Because the responses received from the initial questionnaire represent only a portion of the products considered to be metal furniture, the data analysis represented here may not adequately represent the metal furniture industry as a whole. One questionnaire respondent stated that the data the EPA received does not represent the industry because the coating lines selected for the survey responses were unique and do not represent a balanced cross-section of the industry.

It is also important to note that although powder coating represented a significant percentage of usage by coating type as reported in the initial questionnaire responses, the use of powder coatings industry-wide may not be that prevalent due to technological problems. For example, one facility which manufacturers recliner mechanisms stated that powder coating was not a viable option for their application because the facility uses plastic bushings and washers which are sensitive to the temperature required for the curing of powder coatings. Also, the facility is unable to adequately control coating thickness for prevention of obstruction of the mechanism's scissor action.

The ability of powder coatings to produce certain types of finishes was not demonstrated by several facilities that were the subject of site visits. One facility was unable to create antiqued and marbleized finishes with the powder coatings that had been tested. Another facility which manufactures residential furniture has many unique finish types, including marble, crackle, and pewter finishes, that they have not found to be reproducible with current powder coating technology.

The data obtained by the EPA during this phase of the project is not complete, and additional data gaps exist which hinder a representative data analysis. The purpose of the June 1998 industry questionnaire is to fill these existing data gaps and allow for a more complete database of information from which to perform an analysis. The following list details information that is required to complete the MACT development phase:

- Data from which to perform a complete material balance around unit operations to accurately gauge the level of emissions from each control alternative,
- Cost data to evaluate the cost of controls,
- Data necessary for the evaluation of environmental impacts,
- An accurate means of determining the number of affected sources,
- Data for analysis of possible differences among the industry segments, and
- More complete data on operations other than cleaning before coating application and coating application and curing systems.

III. SURFACE COATING OF METAL FURNITURE

Summary of Existing Federal and State Requirements

The federal regulation applicable to the metal furniture industry is the New Source Performance Standard (NSPS) under 40 CFR Part 60, Subpart EE, "Standards of Performance for Surface Coating of Metal Furniture." In addition to the NSPS, the EPA published a Control Techniques Guideline (CTG) document that covers surface coating of metal furniture. This document, "Control of Volatile Organic Emissions from Existing Stationary Sources Volume III: Surface Coating of Metal Furniture" (EPA-450/2-77-032), was published in December 1977. The following sections summarize the applicability and the performance/control requirements of the NSPS and the CTG.

Applicability of the NSPS

The NSPS applies to metal furniture surface coating operations in which organic coatings are applied. A surface coating operation includes the coating application station(s), flash-off area, and curing oven. The rule specifically excludes metal furniture surface coating operations that use less than 3,842 liters (1,015 gallons) of coating (as applied) per year.

Performance/Control Requirements of the NSPS

The NSPS limits VOC emissions to 0.90 kilogram of VOC per liter of coating solids applied. Compliance is determined by calculating the volume-weighted average mass of VOC discharged to the atmosphere per unit volume of solids applied using given values for the transfer efficiency of various application methods. If the resulting value is less than or equal to 0.90 kilogram of VOC per liter of coating solids applied, the facility is in compliance.

Applicability of the CTG

The CTG applies to the surface coating of metal furniture, which includes any furniture made of metal or any metal part which will be assembled with other metal, wood, fabric, plastic or glass parts to form a furniture piece. According to the CTG, metal furniture may be divided into two categories: "business and institutional" and "household." Business and institutional metal furniture is defined as furniture manufactured for use in hospitals, schools, athletic stadiums, restaurants, laboratories, and other types of institutions, and government and private offices. Household metal furniture is defined as furniture manufactured mostly for home and general office use.

Performance/Control Requirements of the CTG

The CTG recommends a limitation of 0.36 kilogram of organic solvent emitted per liter of coating (minus water) [3.0 pounds of organic solvent emitted per gallon of coating (minus water)]

for reduction of VOC from existing stationary sources. The emission limitation was established as a representation of the presumptive norm which could be achieved through the application of RACT available at the time. The CTG defined RACT to be the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. It may require technology that has been applied to a similar, but not necessarily identical, source category.

State Regulations

A database of State regulations was searched for regulations pertaining to surface coating of metal furniture. Most states generally follow the guidelines established in the CTG as described above. Some States have different limits for individual coating type and curing method (i.e., specialty coatings, air-dried general coatings, baked general coatings, enamels, etc.). Several State/local agencies have established guidance for determining BACT and RACT for surface coating of metal furniture facilities. The EPA has established guidance for the development of VOC RACT requirements.[4] Appendix C summarizes existing metal furniture coating regulations for each State.

Industry Profile

As an initial estimate of the number of major sources potentially affected by the metal furniture MACT standard, information from the TRIS database was analyzed for the four metal furniture manufacturing SIC codes (2514 - metal household furniture; 2522 - office furniture, except wood; 2531 - public building and related furniture; and 2542 - office and store fixtures, partitions, shelving, and lockers, except wood). The data were obtained through EPA's Internet site, specifically, the TRI query form (http://www.epa.gov/enviro/html/tris/tris_query.html).

The TRI query form was used to generate a report of all facilities listed under each of the metal furniture manufacturing SIC codes. Facility-specific data were then requested which included air emissions reported for 1987 through 1995. The last year for which emissions were reported was used for determining if the facility was likely to be a major source (emissions of 9.1 megagrams (10 tons) per year or more of any one HAP or 22.7 megagrams (25 tons) per year or more of any combination of HAP). The list of compounds reported under TRIS, however, is not the same as the HAP list and use of TRIS data is only an indicator of possible major source status.

Overall, 38 percent of the facilities were likely to be major sources, with individual SIC codes ranging from 25 percent to 44 percent as presented below:

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[4] The EPA's Office of Air Quality Planning and Standards has issued a report on CTG requirements that are above VOC RACT entitled "Beyond VOC RACT CTG Requirements" (EPA-453/R-95-010).

SIC Code	Total Number of Facilities	Estimated Number of Major Sources	Estimated Percent Major
2514	36	16	44
2522	91	39	43
2531	52	13	25
2542	65	25	38
TOTAL	244	93	38

The major source estimate was based on actual emissions as reported in the most recent year available in the TRIS database and not on HAP potential to emit as required for MACT. It should be noted that, based on potential emissions, many more facilities could qualify as major sources. Conversely, there is the possibility that some of the major sources may elect to take federally enforceable permit limits or change operations to become synthetic minor sources.

While the above data cover the coating activities cited under the four metal furniture manufacturing SIC codes, there are also an undetermined number of metal furniture facilities listed under the related SIC codes (2599 - furniture and fixtures, not elsewhere classified; 3429 - hardware, not elsewhere classified; 3469 - metal stampings, not elsewhere classified; 3495 - wire springs; 3499 - fabricated metal products, not elsewhere classified; 3645 - residential electric lighting fixtures; 3646 - commercial, industrial, and institutional electric lighting fixtures; 3821 - laboratory apparatus and furniture; 3843 - dental equipment and supplies; 3999 - manufacturing industries, not elsewhere classified; and 7641 - reupholstery and furniture repair). While each of these SIC codes contains products related to the metal furniture industry, each also contains numerous products in other industries. To date, no methodology has been found to distinguish metal furniture facilities from other facilities in any of the SIC code listings which also include non-metal-furniture products. Therefore, an analysis similar to that presented above for SIC codes that only cover metal furniture manufacturing was not performed on the related SIC codes.

Lacking any other methodology to determine the number of metal furniture manufacturing facilities that are major sources in the related SIC codes, the number of major sources in the metal furniture manufacturing SIC codes was doubled to account for the major sources in the related SIC codes for which data were not identified under TRIS. Thus, it is estimated that there are 186 major source facilities nationwide that will be affected by the metal furniture surface coating MACT standards.

Applicability

The metal furniture surface coating source category includes the coating of such items (or component parts) as household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture; office and store fixtures, partitions, shelving, and lockers; commercial, industrial, and institutional lighting fixtures; and wastebaskets that are constructed (in whole or in part) from metal parts or components. Other manufacturing activities that are integral or related to coating activities are raw material preparation, cleaning operations prior to coating application, coating mixing and storage, coating application and curing systems, routine cleaning, and wastewater handling and treatment.

Facilities using these activities to produce metal furniture are typically, but not necessarily, classified under the SIC codes listed in Appendix D. A cross-reference between these SIC codes and their corresponding NAICS codes is also provided in Appendix D.

Metal furniture often contains wood and plastic components, and wood furniture often contains metal components. There are occasions when these dissimilar components are assembled prior to coating, resulting in potential overlaps between MACT surface coating source categories. The EPA has not yet resolved this conflict, particularly where the metal furniture unit contains substantial portions of both metal and wood (or plastic) components.

Another area of possible overlap is between the metal furniture and the miscellaneous metal parts source categories. There are facilities that produce metal parts and components for many different industries, metal furniture being just one. In this case, the issue is whether such a facility would be classified as a miscellaneous metal parts producer, or if it would be classified under one or more of the specific source categories. The EPA has determined, however, that whatever is not included within the specific source categories will, by default, be covered under the miscellaneous metal parts source category.

Facility Operations and Current Industry Practices

The operations discussed in this section are intended to give a broad overview of the entire metal furniture manufacturing process, as well as an indication of which operations may emit HAP materials. While all of these operations are typically found at metal furniture manufacturing facilities, many factors influence the specific collection of operations at any one facility. For example, a facility with shot blast cleaning operations may not require wastewater treatment operations.

Inclusion of an operation in this section is not conclusive that the EPA intends to regulate HAP emissions from the operation. All identified manufacturing operations are included here for completeness of the description of the manufacturing process and for identifying type of pollutants and total emissions from a facility.

Raw Material Preparation

Raw materials consist of tube or bar stock, or coiled steel sheet. The material is cut to size and processed through various stamping, forming, bending, and welding operations to produce the component pieces. The individual pieces are then assembled into a completed unit or component part (such as legs or supports for a table with a wooden top) by welding or through the use of various fasteners. At this point, the unit or component part is ready for coating application. However, some items, particularly office furniture such as filing cabinets, will require assembly operations after coating, and other items will require the addition of non-metal components such as wood shelves or desktops.

Based on information obtained from one facility, small amounts (typically less than 1 kilogram per year) of HAP emissions may occur from welding operations due to inorganic HAP materials contained in the welding rods. This estimate was based on their annual usage of welding rods and the inorganic HAP content of the welding rods as reported in its material safety data sheet. This estimate is generally consistent with Section 12.19 of AP-42,[5] which lists HAP emission factors for various types of welding operations.

Cleaning Operations Prior to Coating Application

Before a metal furniture unit or component part can be coated, its surface must be thoroughly cleaned. Nearly all cleaning operation systems prior to coating reported in the responses to the initial questionnaire and observed during site visits followed the same basic procedure as shown in Figure III-1. This operation consists of the following basic stages: 1) alkaline or acidic cleaning, 2) water rinse, 3) phosphate treatment (typically iron phosphate), 4) water rinse, and 5) pretreatment and/or water rinse. The final pretreatment step may be a rust inhibitor or adhesion promoter. Also, each rinse stage may consist of multiple rinses in series. Including the rinse stages, the reported cleaning lines ranged from two to six stages. In all cases, the cleaning operation was followed by an oven drying stage.

Two facilities that the EPA visited used a different cleaning procedure. Both facilities produced a variety of residential furniture and used a shot blasting operation as the sole means of cleaning prior to coating (one facility powder coated, the other used liquid coatings). Dirt and grease, as well as rough edges and welds, were abrasively removed by this operation. In addition, cured powder coatings could be removed when items required rework. No solvents or liquid cleaners were used, and the facilities had no wastewater discharge.

[5] Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. Section 12.19. January 1995.

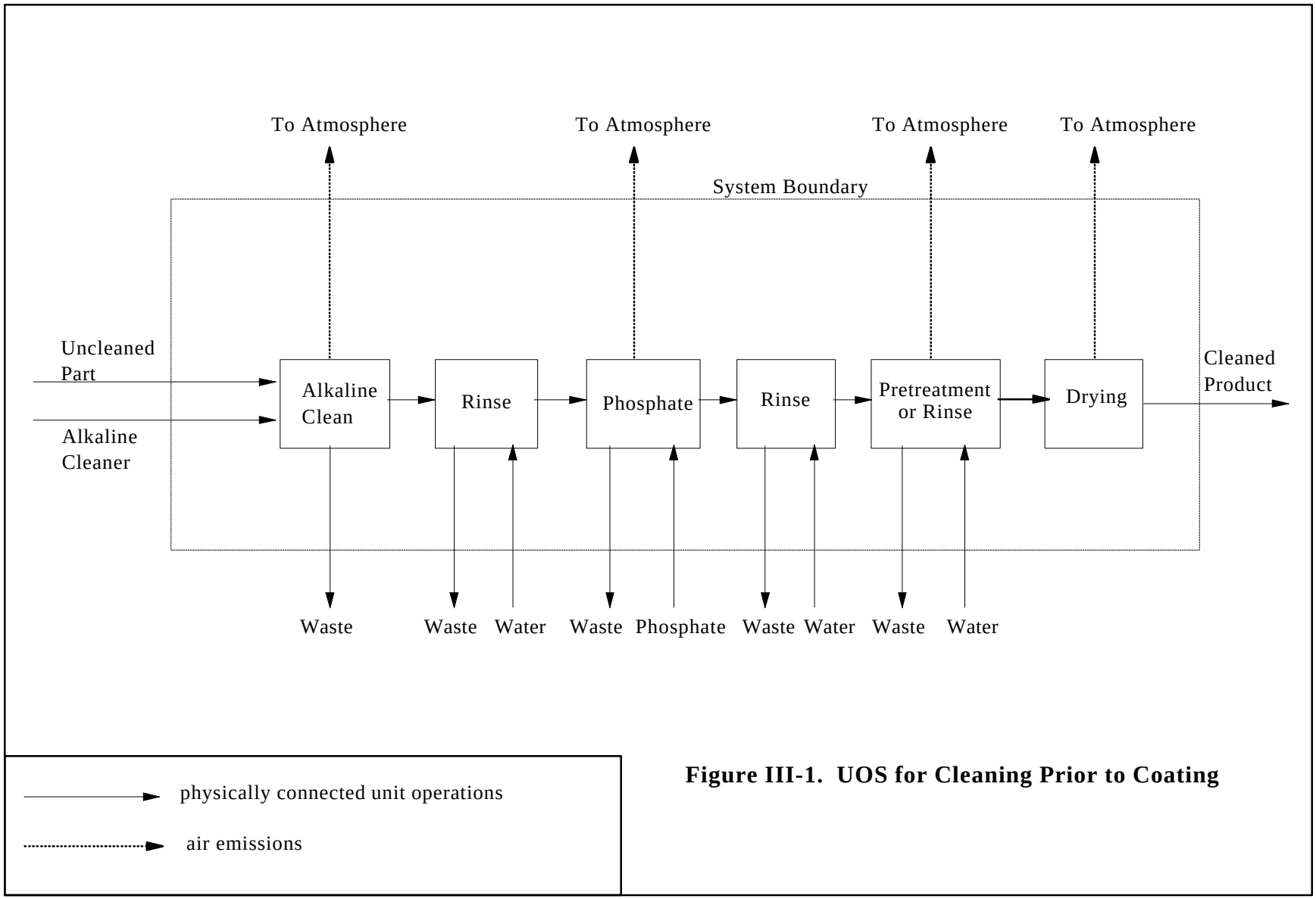

Figure III-1. UOS for Cleaning Prior to Coating

In general, the cleaning systems prior to coating contain little volatile HAP or VOC materials, and no such emissions were reported in the initial questionnaire responses. In addition, the EPA's Factor Information Retrieval System (FIRE database) indicates VOC emissions from these cleaning systems (SCC code 4-02-020-02, metal furniture cleaning and pretreatment operations prior to coating) are negligible (emission factor is reported as 0.0 lb VOC/ton solvent in coating). No emission factors are listed for HAP materials in the FIRE database for this SCC code.[6]

Coating Mixing and Storage

Coatings may be used directly as received from the manufacturer or mixed with a small amount of solvent (i.e., thinner) to adjust viscosity before application. In addition, multiple components may be mixed to form the as-applied coating. When a solvent is mixed with the coating or multiple components are combined, a mixing operation separate from the application operation is required. Even coatings used as received are typically mixed prior to use to ensure that all components are uniformly distributed in the coating.

The mixing operation may take place at the coating application operation, or there may be a dedicated room or area of the facility where mixing takes place. Mixing at the coating application operation is used only where the amount of coating to be mixed is small, such as specialty coatings or short product runs. Dedicated mix rooms are employed for coatings used in large quantities and may serve multiple coating application operations. In either case, the mixing operation is generally the same, with the size and number of the mixing tanks being the only variable.

Coatings are mixed in tanks sized appropriately for the expected usage of the coating. Each tank is continually mixed by means of an electric mixer mounted on the tank. Dedicated mix rooms usually supply coatings to more than one application operation. The mixing tanks may be piped directly to each coating line but are more typically piped in a circuitous fashion, eventually returning to the mixing tank. Each coating application operation can then tap into this line and have a continuous supply of coating. Samples are taken from the mixing tanks periodically to check for viscosity. Small amounts of solvent may be added to keep the coating in the desired viscosity range.

Emissions from mixing operations occur from the evaporation of solvents from the mixing tanks. These emissions are generally fugitive in nature, although individual tank exhaust could be provided. Closed mix rooms are ventilated to prevent solvent concentrations in the room air from exceeding safe levels. The exhaust is usually vented to the atmosphere.

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[6] Factor Information Retrieval System, Version 5.1B. U.S. Environmental Protection Agency. Research Triangle Park, NC. December 1996.

Coatings are stored in sealed containers, either in the mix rooms or dedicated storage areas. Because the containers are kept sealed until use, there are essentially no emissions from storage.

Electrolytic Plating

Electrolytic plating is far less prevalent than application and curing of an organic coating as a choice for surface finishing of metal furniture, but has been observed for specific applications in the residential, outdoor, and office furniture industry segments. A plating line consists of a series of dip tanks into which the parts are immersed. In general, the first stage is a cleaner which removes dirt and grease. This is followed by pretreatment stages designed to prepare the surface for plating and to prevent contaminants from being introduced into the plating bath. The plating stage can consist of one or more separate steps, such as chromium, nickel, zinc, or brass, depending on the desired final finish. A final rinse completes the plating operation.

HAP emissions from electrolytic plating operations usually occur from aerosols released from the surface of the liquids in the tanks due to aeration or off-gassing produced during the electrolytic plating step. Volatile organic HAP materials are generally not used in these operations, so HAP emissions are confined to inorganic HAP materials.

Coating Application and Curing Systems

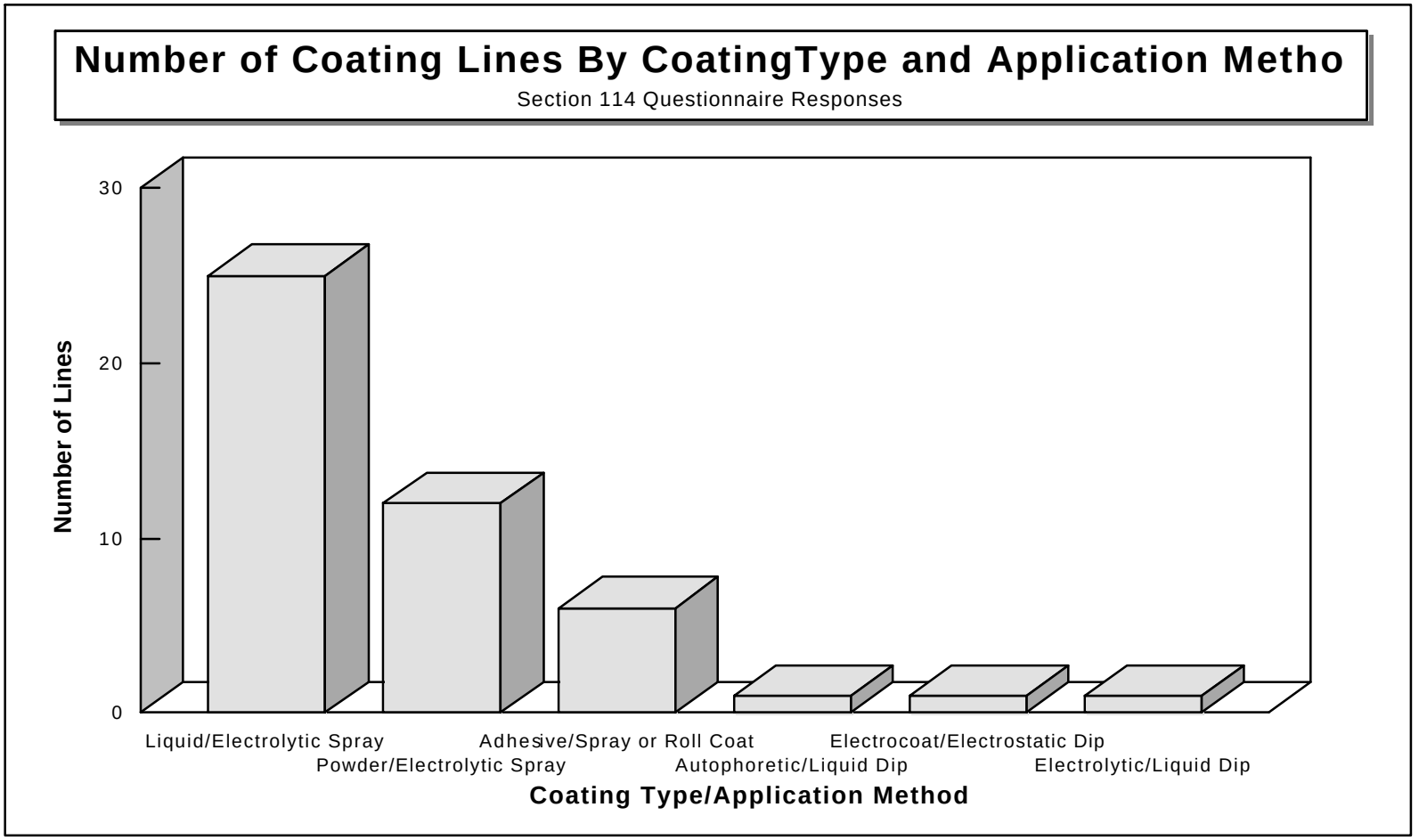
The vast majority of coating in the metal furniture industry is accomplished by means of applying an organic-based coating to the metal part, then curing or drying. The coating itself may be in the form of liquid or powder, and may be spray or dip applied. Nearly all sprayable coatings are electrostatically applied, as well as many dip coatings. The distribution of coating lines by coating type and application method as reported in the initial industry questionnaire responses is shown in Figure III-2.

Liquid Coatings

Sprayable liquid coatings are applied in a booth by manual or automatic means. In some instances, both are used to maximize coating application efficiency. Typically, the overspray is collected on dry filters within the booth (waterwash booths appear to be less commonly used), and the filters are subsequently disposed as waste. Alternatively, some facilities collect the overspray for reuse. After coating application, the parts pass through a flash-off area which allows a substantial portion of the solvent to evaporate before being subjected to the heat of the curing oven.

HAP emissions from liquid coating operations occur at each step of the operation. During application of the coating, volatile solvents are evaporated from the coating. Small droplets of overspray that are not filtered from the spray booth exhaust may be released into the

FIGURE III-2


Number of Coating Lines By CoatingType and Application Metho
Section 114 Questionnaire Responses
Number of Lines
30
20
10
0
Liquid/Electrolytic Spray
Powder/Electrolytic Spray
Adhesive/Spray or Roll Coat
Autophoretic/Liquid Dip
Electrocoat/Electrostatic Dip
Electrolytic/Liquid Dip
Coating Type/Application Method

atmosphere, generating emissions of inorganic HAP material. During flash-off and curing, the solvent continues to evaporate until the coating is fully cured. A wide range of solvents are used in the coatings, with methyl ethyl ketone, 2-butoxyethanol, n-butyl acetate, xylene, and toluene being some of the most prevalent reported in the initial questionnaire responses.

Powder Coatings

Powder coatings are almost always applied by means of electrostatic spray. When a single color is applied within a dedicated booth (or during a long production run in a booth used for multiple colors), most of the powder overspray is collected and reused (see Figure III-3). Most facilities that recycled the powder reported that approximately five percent of the powder was lost as waste. When multiple colors are applied within the same booth, the powder overspray is typically not reused due to the difficulty of keeping residues of one color from contaminating another color (see Figure III-4).

After application of the powder coating, no flash-off is necessary because the powder applied this way contains no liquid components. The coated parts are conveyed directly to a curing oven where the powder is melted and fused into a continuous coating.

While powder coatings are gaining wide acceptance in the metal furniture industry, they have not been demonstrated for certain types of finishes. One facility visited by the EPA was unable to create antiqued and marbleized finishes with the powder coatings they tested. Another facility which manufactures residential furniture has many unique finish types, including marble, crackle, and pewter finishes, that may not be producible with current powder coating technology.

Metal furniture pieces produced from hollow tube stock at one residential furniture manufacturing facility that is in the process of converting to powder coating are currently dip coated to ensure that inside areas are fully coated and will not rust. The success of the powder coating operation for this application will depend on the ability to coat the interior of hollow component parts with a sealer to prevent rusting. The facility anticipates that this may be accomplished by adding a sealer to the cleaning system prior to coating; however, this has not yet been tested.

One facility which manufacturers recliner mechanisms stated that powder coating was not a viable option for their application. The mechanisms contain plastic bushings and washers which are assembled prior to coating. These plastic components are too heat sensitive to be exposed to the temperature required to cure powder coatings. The facility also expressed concern about the ability to control powder coating thickness on all areas of the mechanism so that it would not obstruct its scissor action.

Although no volatile emissions occur from the powder application step, some facilities vent the application booth to the atmosphere, leading to particulate matter emissions. The majority of facilities that responded to the initial industry questionnaire, as well as those who

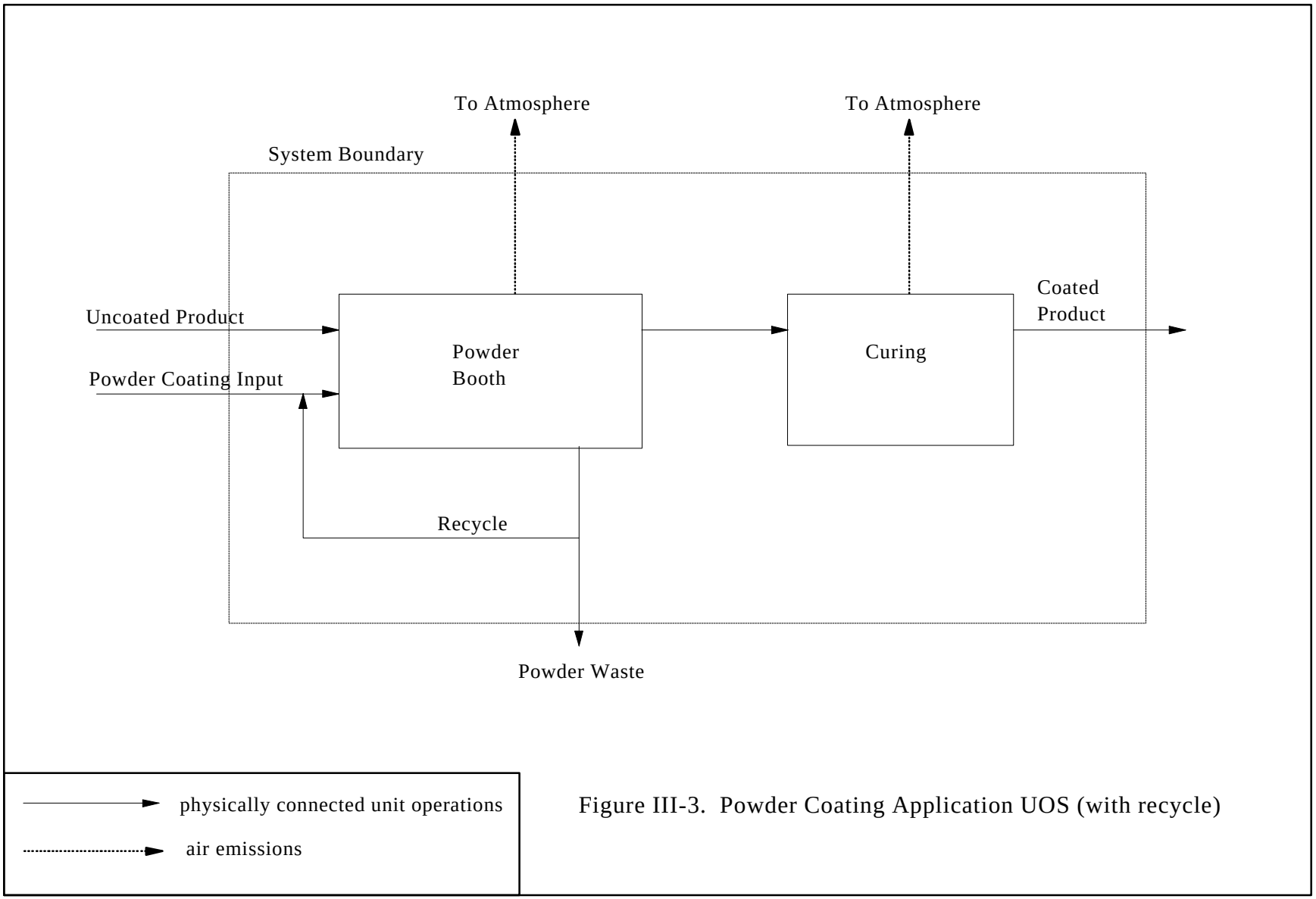


Figure III-3. Powder Coating Application UOS (with recycle)

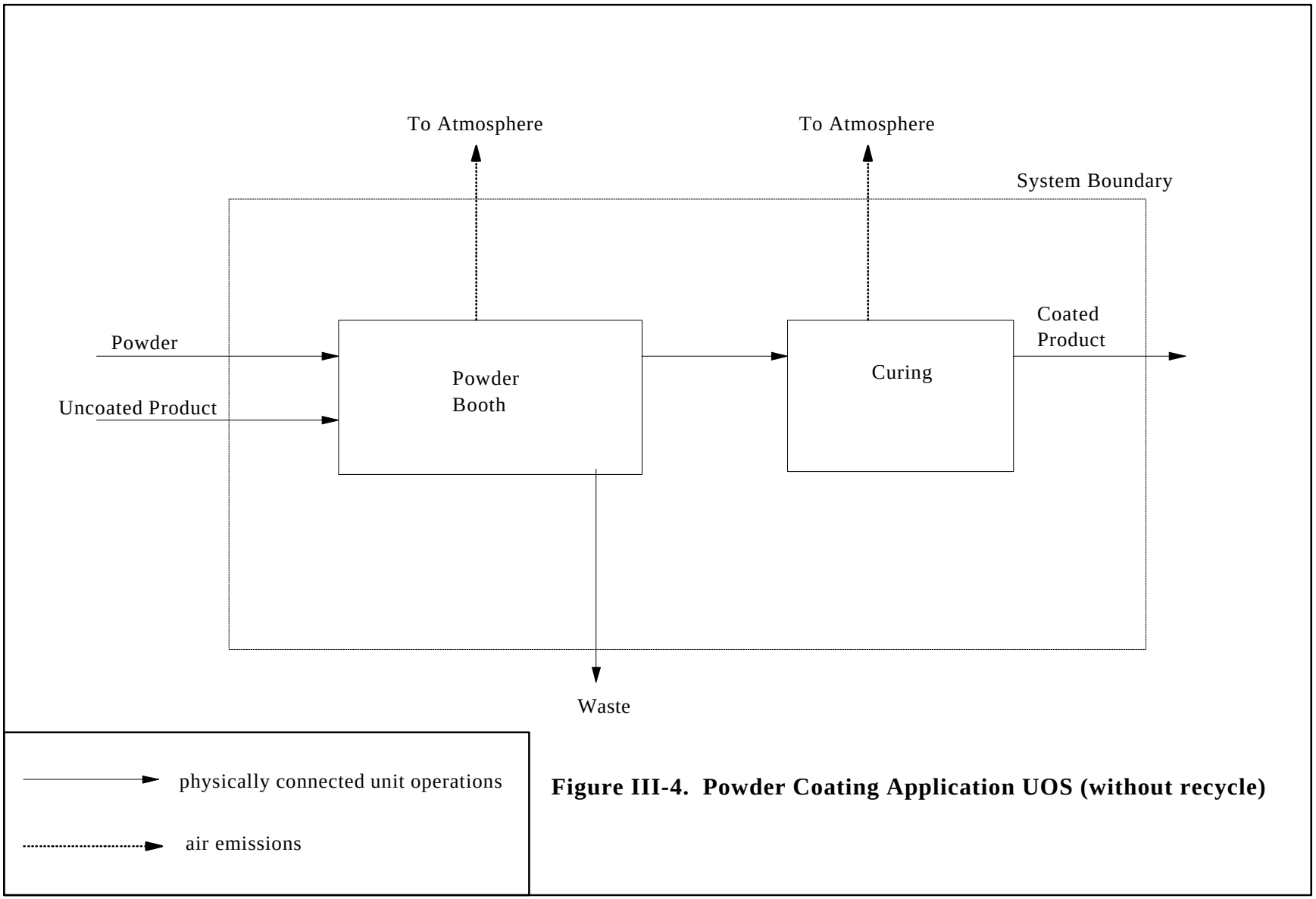


Figure III-4. Powder Coating Application UOS (without recycle)

were the subject of site visits, returned the spray booth exhaust air back to the booth rather than discharging it to the atmosphere.

Depending on the specific resin type and additives used in the powder formulation, volatile emissions may be produced during curing by two different mechanisms. First, volatile components in the formulation may be released when the powder is subjected to heat. The second mechanism is a chemical reaction between the powder additives when exposed to the heat of the curing oven that creates volatile compounds. These latter components are termed cure volatiles.

While no information was obtained concerning the amount or speciation of the cure volatiles, some available data on emissions of additives were collected. According to information provided by a powder coatings manufacturer for a urethane polyester powder, two to six percent by weight of the powder may be released in the curing step. For this particular powder formulation, caprolactam was the material emitted. Caprolactam is not a HAP but is a VOC.

Additionally, a facility engineering report from the Chattanooga-Hamilton County (Tennessee) Air Pollution Control Bureau (APCB) for a metal furniture powder coating operation indicated that emissions may occur from the curing of powder coatings at temperatures greater than 160°C (320°F).[7] Each of the powder coatings used at the facility for which the engineering report was developed may contain two to four percent by mass caprolactam and 10 to 20 percent by mass isophorone diisocyanate (IPDI). The report stated that as much as one half of the caprolactam may be volatilized during powder curing and 1 to 2 percent of the IPDI may be volatilized.

Other Technologies

While liquid and powder spray-applied coatings are used by the majority of the industry, other application methods and coating technologies have been demonstrated. Dip application methods are used primarily on parts that do not require a high quality appearance, such as interior components of a filing cabinet. 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 than traditional dip application. Autophoretic coating is a dip application method where a chemical reaction deposits the coating on the surface of the part. In the one autophoretic operation for which data have been obtained, the only available color was black. The coating contained a negligible amount of HAP and no VOC material.

Adhesives

[7] Chattanooga-Hamilton County (Tennessee) Air Pollution Control Bureau, Village Smith, L.P. Facility Engineering Report; Sharon H. Dingman, Engineering Department; June 15, 1997.

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. In most instances, the adhesive is activated by pressure, not heat.

The solvent contained in the adhesive evaporates during application and curing, similar to that described above for other organic coatings.

Routine Cleaning

Cleaning other than in preparation for surface coating also occurs at nearly every metal furniture manufacturing facility. These operations include spray gun cleaning, paint line cleaning, and touch-up cleaning at final assembly. Each of these operations is typically conducted with an organic solvent. Emissions, which occur from the evaporation of these solvents, are usually fugitive in nature.

Wastewater Treatment and Handling

The primary source of wastewater from metal furniture manufacturing operations is the rinse stages of the cleaning operation shown in Figure III-1. The wastewater is typically adjusted for pH, then discharged from the facility. Additional treatment may be necessary depending on the oil and grease loading and other contaminant levels.

IV. EMISSION REDUCTION TECHNIQUES

The initial industry questionnaire, as well as the site visits conducted by the EPA, focused heavily on cleaning and coating unit operations because emission sources associated with these operations constitute the majority of HAP emissions from metal furniture manufacturing facilities. Information obtained concerning the other unit operations discussed in Section III was minimal and did not provide enough data to adequately discuss emission reduction techniques used in current practice by the industry. Consequently, emission reduction techniques for only cleaning prior to coating application and coating application and curing systems are discussed in this section.

Cleaning Operations Prior to Coating Application

As discussed in Section III, the cleaning operations observed during site visits and reported in the responses to the initial questionnaire contain little volatile HAP (or VOC) materials. As such, there is essentially no room for improvement, in terms of reducing HAP emissions, over the methods in wide use by the industry.

While opportunities for HAP emission reductions have not been identified, the shot blast cleaning operation observed at two facilities offer significant reductions in wastewater and liquid waste streams. The shot blasting operation, being completely dry, produces no wastewater from the rinsing of parts between cleaning steps. In addition, the liquid waste stream produced when the cleaning/treatment solutions are disposed would be eliminated by a shot blast operation.

No restrictions on the type of metal substrate were identified for use of shot blast cleaning operations. However, if the unit or component part being cleaned has non-metal parts assembled before the cleaning operation, then shot blasting may not be a viable alternative due to the abrasive nature of the operation. Another drawback of the shot blast cleaning operation is its batch mode of operation. Compared to a conveyorized cleaning operation that is in-line with the coating application operation, more labor is involved for the additional steps of loading and unloading from the shot blast chamber.

Of the two facilities visited by the EPA that had shot blast cleaning operations, only one had an emission stream vented to the atmosphere. This emission stream, which contained residual dust generated within the blast chamber during the cleaning cycle, was controlled by means of a particulate filter. HAP emissions from this source were not documented, but small amounts of inorganic HAP materials could be emitted depending on the composition of the shot and the metal substrate being cleaned. The second facility filtered the air from the blast chamber in a similar manner, except that the air was recirculated back to the chamber. In both cases, the air was filtered only after the cleaning cycle was completed in order to reduce the dust in the chamber so that the door could be opened sooner.

Coating Application and Curing Systems

The most prevalent coating application and curing system used in the metal furniture manufacturing industry is the spray application of liquid coatings followed by curing or drying in an oven. Although these systems have the broadest applicability throughout the industry, they typically have the highest HAP and VOC emissions as well. Through the initial data gathering effort, the EPA has identified several alternative coating application and curing systems that have the potential to reduce HAP and VOC emissions compared to conventional liquid coatings, as described below.

The EPA's RACT/BACT/LAER Clearinghouse was searched by metal furniture manufacturing SIC codes to determine the current control technologies that have been implemented as BACT, RACT, and LAER. Of the three facilities identified in the Clearinghouse, one facility utilized high solids (nonvolatiles) sprayable liquid coatings as a means of VOC control, another facility utilized high solids sprayable liquid coatings and application methods (automatic bells and hand-held electrostatic guns) as BACT for VOC control, and the third facility utilized an application method (high volume low pressure (HVLP) spray guns) as BACT for VOC control. The permit issuance dates for these facilities were September 1990, April 1991, and March 1994, respectively.

This trend was also seen in the responses to the initial industry questionnaire and the site visits. High solids sprayable liquid coatings in combination with electrostatic spray guns (both manual and automatic) were reported as the primary means used to reduce volatile emissions from coating application operations. In addition, some facilities utilized other application methods such as rotary bell and rotary disk electrostatic spray.

High solids coatings reduce emissions by reducing the amount of solvent in the coating as applied. As a result, a smaller volume of high solids coating is required to cover a given surface area at a given transfer efficiency. For example, one liter (0.264 gallon) of solids will coat a surface area of 39.4 m^2 (424 ft^2) at a thickness of 2.54×10^{-5} m (0.001 in. or 1 mil), assuming 100 percent transfer efficiency. Using a conventional coating with 30 volume percent solids would require 3.33 liters of coating to cover this surface area. By contrast, a high solids coating with 65 volume percent solids would require 1.54 liters to cover the same area. The reduced total volume of high solids coating required, combined with the lower solvent content per liter, substantially reduces volatile emissions. Additional information on low-emitting coatings is included in a study by the EPA's Office of Research and Development.[8]

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[8] The EPA's Office of Research and Development has issued a report on low emitting adhesives that are being used by the pressure sensitive tape industry. The report, "Solvent-Based to Waterbased Adhesive-Coated Substrate Retrofit, Volume I-IV" (EPA-600/R-95-011x), includes information on facilities that have converted to waterborne adhesives and a discussion of the equipment required to retrofit a coating line to use waterborne adhesives. Although the report focuses on waterborne adhesives, the information on retrofitting a coating line to use waterborne

Powder coatings also represent a control technology widely used by the metal furniture industry. The coating, being a dry powder, has no solvent to evaporate, although a small amount of volatile components may be emitted. As described in Section III, a maximum of approximately five percent by weight of the powder coating is emitted, compared to approximately 25 percent by weight of a typical high solids (65 percent by volume solids) coating.

Add-on control devices were used by only three facilities that responded to the initial industry questionnaire or were the subject of a site visit to control HAP/VOC emissions in the metal furniture industry. One facility is currently utilizing a thermal oxidizer for control of VOC from two paint curing ovens. Another facility controls VOC emissions from spray booths via a carbon concentration/carbon adsorption system followed by an oxidizer. The third facility previously utilized a catalytic thermal oxidizer for control of VOC emissions from a liquid coating line; however, it was taken off-line due to the conversion of the liquid coating line to a powder line.

Resources

Additional information may be obtained from the EPA's coatings MACT database as it continues to be updated. The database (also called the AIRS/AFS database) can be accessed through the EPA's website on the Internet (http://www.epa.gov/ttn).

In addition, NESHAP and NSPS developed for other surface coating operations may help to identify compliance options and/or control measures applicable to the metal furniture industry. These regulations are as follows:

- Aerospace Manufacturing and Rework Facilities, 40 CFR Part 63, Subpart GG; *Aerospace Manufacturing and Rework Facilities--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-94-036a)

- Shipbuilding and Ship Repair (Surface Coating), 40 CFR Part 63, Subpart II; *Shipbuilding and Ship Repair Facilities (Surface Coating)--Facilities--Background Information for Final Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-96-003b)

- Wood Furniture Manufacturing Operations, 40 CFR Part 63, Subpart JJ; *Wood Furniture Manufacturing Operations--Background Information for Final Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-95-018b).

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coatings is applicable to all types of coatings.

- Printing and Publishing Industry, 40 CFR Part 63, Subpart KK; *Printing and Publishing Industry--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-95-002a).

- Printing and Publishing Industry, 40 CFR Part 63, Subpart KK; *Printing and Publishing Industry--Background Information for Promulgated Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-96-005b).

- Pressure Sensitive Tape and Label Surface Coating Industry, 40 CFR Part 60, Subpart RR; *Pressure Sensitive Tape and Label Surface Coating Industry--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-450/3-80-003a).

- Flexible Vinyl Coating and Urethane Coating and Printing Operations, 40 CFR Part 60, Subpart FFF; *Flexible Vinyl Coating and Printing Operations--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-450/3-81-016a).

- Magnetic Tape Manufacturing Industry, 40 CFR Part 60, Subpart SSS; *Magnetic Tape Manufacturing Industry--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-450/3-85-029a).

- Magnetic Tape Manufacturing Industry, 40 CFR Part 60, Subpart SSS; *Magnetic Tape Manufacturing Industry--Background Information for Promulgated Standards, Final EIS*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-450/3-85-029b).

- Magnetic Tape Manufacturing Operations, 40 CFR Part 63,Subpart EE; *Hazardous Air Pollutant Emissions from Magnetic Tape Manufacturing Operations--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-93-059).

- Magnetic Tape Manufacturing Operations, 40 CFR Part 63,Subpart EE; *Hazardous Air Pollutant Emissions from Magnetic Tape Manufacturing Operations--Background Information for Promulgated Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-94-074b).

- Polymeric Coating of Supporting Substrates, 40 CFR Part 60, Subpart VVV; *Polymeric Coating of Supporting Substrates--Background Information for Proposed Standards*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-450/3-85-022a).

- *Beyond VOC RACT CTG Requirements*, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (EPA-453/R-95-010).

The Office of Research and Development report on pollution prevention measures for cleaning operations[9] may also be useful for other potential sources of HAP emissions. Also, the Alternative Control Techniques Document--Industrial Cleaning Solvents[10] may be beneficial in determining alternate control methods.

[9] The EPA's Office of Research and Development has released a report on equipment cleaning practices at coated and laminated substrate manufacturing facilities entitled "Improved Equipment Cleaning in Coated and Laminated Substrate Manufacturing Facilities" (EPA-600/R-94-007 and EPA-600/R-95-097).

[10] The EPA's Office of Air Quality Planning and Standards has released a report on alternate control techniques for industrial cleaning solvents entitled "Alternate Control Techniques Document--Industrial Cleaning Solvents" (EPA-453/R-94-015).

V. SUMMARY OF COMMENTS

One comment was received concerning a misreference to an appendix. The correction was made to the text.

APPENDIX A

DEFINITIONS

DEFINITIONS

The following are definitions of important terms established during the P-MACT phase:

Add-on control device means an air pollution control device installed at the end of a process vent exhaust stack or stacks that reduces the quantity of a pollutant that is emitted to the air. The device may destroy or secure the pollutant for subsequent recovery. Examples are incinerators, condensers, carbon adsorbers, and bioreactor units which reduce the pollution in an exhaust gas. Transfer equipment and ductwork are not considered in and of themselves add-on air pollution control devices. The control device usually does not affect the process being controlled and thus is "add-on" technology as opposed to a scheme to control pollution through making some alteration to the basic process.

Affected source means, with reference to a stationary source, any apparatus to which a standard is applicable. Any operation or process line that is subject to a regulation or standard.

As-applied means the condition of a coating at the time of application to the substrate, including any thinning solvent or any other additives.

Batch means the product of an individual production run of a coating manufacturer's process. A batch may vary in composition from other batches of the same product.

Capture means the containment or recovery of emissions from a process for direction into a duct, which may be exhausted through a stack or sent to an abatement or recovery device before exiting through a stack.

Clean Air Act -- The Clean Air Act, as amended in November 1990, provides the foundation for EPA's efforts to improve air quality. The Clean Air Act, building on earlier legislation, was passed in 1970.

Cleaning activity means the action used to clean a substrate. This term focuses on how the substrate is being cleaned, and includes actions such as wiping, brushing, flushing, spraying, or dipping.

Cleaning of parts means solvent engulfs the entire surface of the item (part) as it is dipped in a container of solvent, or the part is cleaned above the container by a cleaning activity such as spraying or wiping. Equipment, the "unit operation," where this might take place, includes part washers, batch-loaded cold cleaners, ultrasonic cleaners, and spray gun washers.

Cleaning operation means a unit operation in which a substrate is cleaned. This term focuses on what is being cleaned (e.g., spray booth cleaning operation or parts cleaning operation). Cleaning may be performed to prepare a surface for coating or for other purposes.

Cleaning solvent means an organic solvent used for cleaning.

Coater or coating applicator means the apparatus used to apply a coating to a continuous base substrate.

Coating means a protective, decorative, or functional layer of a material applied to a substrate or surface. The applied coating cures to form, for most materials, a continuous solid film. This term often applies to paints such as lacquers or enamels, but also applies to other coatings that do not have a resin. Adhesives and caulks are being treated as coatings.

Coating application means the process by which the coating is applied to the base substrate.

Coating application station means the part of a coating operation where the coating is applied. In a spray operation, it is the spray booth and is distinguished from the flash off area and oven.

Coating line means any number or combination of coating applicators, flash off areas, and ovens which coat a substrate.

Coating operation means, for the purposes of this document, those activities in which a coating is applied to a substrate and is subsequently air dried, cured in an oven, or cured by radiation.

Coating solids means the part of the coating which remains after the coating is dried or cured; solids (nonvolatile) content is reported based on test data or formulation data.

Constructed Major Source means (1) to fabricate, erect, or install at any greenfield site a stationary source or group of stationary sources which is located within a contiguous area and under common control and which emits or has the potential to emit 10 tons per year of any HAP or 25 tons per year of any combination of HAP, or (2) to fabricate, erect, or install at any developed site a new process or production unit which in and of itself emits or has the potential to emit 10 tons per year of any HAP or 25 tons per year of any combination of HAP....

Control means the abatement of pollutants which might be exhausted into the atmosphere. It often refers to the collection or destruction efficiency using various technologies, including incinerators or carbon adsorbers as opposed to capture of the pollutants into the device.

Control device (see Add-on control device)

Control Techniques Guidelines (CTG) means a series of documents prepared by the EPA to assist states in defining reasonably available control technology (RACT) for major sources of volatile organic compound (VOC) material. The documents provide information on the economic and technological feasibility of available techniques and, in some cases, suggest limits on VOC emissions.

Cure Volatiles means reaction products which are emitted during the chemical reaction which takes place in some coating films at the cure temperature. These emissions are other than those from the solvents in the coating and may, in some cases, comprise a significant portion of total VOC and/or volatile HAP emissions.

Dip coating means a method of applying a coating in which the substrate is dipped into a tank of coating and then withdrawn.

Electrodeposition (Electrocoat) means a dip coating method in which an electric field is used to promote the deposition of the coating onto the part. The part being painted acts as the electrode which is oppositely charged from the coating particles in the dip tank.

Electrostatic spray is produced when opposite electrical charges are applied to the substrate and the coating. The coating is attracted to the object by the electrostatic potential between them. The coating may be applied by either a spray gun (nonrotational method) or a gun with a rotating bell or disk applicator (rotational method).

Emission reduction means the decrease in HAP or VOC material emitted when (1) an alteration is made to the basic operation or process or (2) an add-on control device (such as a carbon adsorber or incinerator) is used. Emission reduction is often expressed as a percentage.

Exempt compound means specific organic compounds that are not considered volatile organic compounds due to negligible photochemical reactivity. Exempt compounds are specified in 40 CFR 51.100(s).

Existing source means any stationary source of air pollution other than a new source.

Facility means all contiguous or adjoining property that is under common ownership or control, including properties that are separated only by a road or other public right-of-way.

Film thickness means the thickness of the dry cured coating on the substrate.

Flash off area means the portion of a coating operation between the coater and the drying oven where solvent begins to evaporate from the coated base substrate.

Fugitive emissions means emissions that do not pass through a stack or duct that allows for their measurement.

HAP or Hazardous Air Pollutant means any air pollutant listed in or pursuant to Section 112(b) of the Clean Air Act.

Higher solids (nonvolatiles) coating means coatings containing a considerably higher solids content than conventional coatings. These coatings typically contain greater than 60 percent solids by volume.

High volume low pressure (HVLP) spray equipment means spray equipment that is used to apply coating by means of a spray gun that operates at 69.0 kPa (10.0 psig) or less of atomizing air pressure at the air cap.

Major source means any source that emits or has the potential to emit 9.1 megagrams (10 tons) per year or more of any one HAP or 22.7 megagrams (25 tons) per year or more of any combination of HAP.

Material balance means a calculation based on conservation of mass (i.e., the mass of material going into a unit operation is equal to the mass of material which leaves the unit operation). This calculation is often used to estimate volatile emissions.

Metal Furniture means such items (or component parts) as household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture; office and store fixtures, partitions, shelving and lockers; commercial, industrial, and institutional lighting fixtures; and wastebaskets using any combination of the following operations: raw material preparation, cleaning, coating mixing and storage, coating application, coating curing or drying, and wastewater handling and treatment.

New source means any stationary source the construction or reconstruction of which commences after a specified date, usually the proposal or promulgation of an applicable standard of performance.

New Source Performance Standard (NSPS) means standards for emission of air pollutants from new, modified, or reconstructed stationary emission sources which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated. The Clean Air Act usually refers to these as standards of performance for new stationary sources.

Nonvolatiles or solids means the nonvolatile portion of the coating that after drying makes up the dry film.

Oven means a chamber which uses heat or irradiation to bake, cure, polymerize, or dry a surface coating.

Pollution Prevention means practices or process changes that decrease or eliminate the creation of emissions or waste at the source of pollution (e.g., a paint spray booth). Such prevention

techniques include use of new materials, modification of equipment, and changes in work practices that result in emission reduction at the source.

Potential to Emit means the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the stationary source to emit a pollutant, including air pollution control equipment and restrictions onhours of operation or on the type or amount of material combusted, stored, or processed shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable.

Powder coating means any coating applied as a dry (without solvent or other carrier), finely divided solid which adheres to the substrate as a continuous film when melted and fused.

Process (process line) means the aggregate of unit operations necessary for producing a product. The emissions from a process includes all sources of air emissions (e.g., storage, transfer, handling, mixing, painting, and packaging).

Reasonably Available Control Technology (RACT) means the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. RACT is usually applied to existing sources in nonattainment areas and in most cases is less stringent than new source performance standards.

Reconstructed Major Source means the replacement of components at an existing process or production unit that in and of itself emits or has the potential to emit 10 tons per year of any HAP or 25 tons per year of any combination of HAP, whenever: (1) the fixed capital costs of the new components exceed 50 percent of the fixed capital cost that would be required to construct a comparable process or production unit; and (2) it is technically and economically feasible for the reconstructed major source to meet the applicable maximum achievable control technology emission limitation for new sources established under this subpart.

SIC/NAICS codes refers to the Standard Industrial Classification codes (1987) and their replacements, the North American Industrial Classification System codes. For more information on SIC and NAICS codes, visit the following Internet site:
http://www.census.gov/epcd/www/naics.html

Solids (see Nonvolatiles or solids)

Solvent means the liquid or blend of liquids used to dissolve or disperse the film-forming particles in a coating and which evaporate during drying. A true solvent is a single liquid that can dissolve the coating. Solvent is often used to describe terpenes, hydrocarbons, oxygenated compounds, furans, nitroparaffins, and chlorinated solvents.

Surface coating operation means the application of a coating which covers the surface of an object. The project is collecting data on protective oils. However, no decision has been made regarding whether they will be regulated.

Surface preparation means the removal of contaminants from the surface of a substrate or component or the activation or reactivation of the surface in preparation for the application of a coating.

Thermal incinerator means a device for oxidizing waste material via flame and heat. This contrasts with a catalytic incinerator which incorporates a catalyst to aid the combustion.

Transfer efficiency means the ratio of the amount of coating solids (nonvolatiles) deposited onto the surface of the coated part to the total amount of coating solids used.

Treatment means any method, technology, or process designed to remove solids and/or pollutants from solid or liquid wastes, waste streams, effluents, or air emissions.

Unit operation means an industrial operation, classified or grouped according to its function in an operating environment (i.e., a paint mixing vessel, a spray booth, etc.).

Unit operation system (UOS) means the ensemble of equipment around which a material balance is performed. The "boundary" of a UOS may include one or more unit operations (e.g., a coating line or a coating line plus mixing tanks). What constitutes a UOS for presenting emissions/waste data needs to be defined on an industry by industry basis. However, common UOSs may be found across industries.

Volatile organic compound (VOC) means any compound defined as VOC in 40 CFR 51.100(s). This includes any organic compound other than those determined by the EPA to be an ‘exempt’ compound.

Volume percent solids means the portion of a coating which remains as part of the cured film expressed as percent by volume.

Wastewater means any process waters or cleaning waters leaving the process unit.

APPENDIX B

LIST OF STAKEHOLDERS

METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

Name	Company	Mailing Address	Telephone/Fax Number	e-mail Address
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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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METAL FURNITURE P-MACT EPA/INDUSTRY/STATES WORK TEAM

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APPENDIX C

STATE REGULATION SUMMARY

SUMMARY OF REGULATIONS BY STATE

STATE	METAL FURNITURE SURFACE COATING LIMITS
Alabama	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Arkansas	clear coatings - 0.52 kg/l (4.3 lb/gal), extreme performance coatings - 0.42 kg/l (3.5 lb/gal), all other coatings - 0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Bay Area AQMD (California)	baked coatings - 275 grams/liter (2.3 lb/gal), air dried coatings - 340 grams/liter (2.8 lb/gal), specialty coatings are broken into five categories with different limits for both baked and air dried
SanDiego County APCD (California)	General air dried coatings - 340 grams/liter (2.8 lb/gal), General baked coatings - 275 grams/liter (2.3 lb/gal), 22 specialty coatings with different limits for both baked and air dried
South Coast AQMD (California)	General air dried coatings - 340 grams/liter (2.8 lb/gal), General baked coatings - 275 grams/liter (2.3 lb/gal), 22 specialty coatings with different limits for both baked and air dried, separate adhesive limits
Colorado	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Connecticut	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Delaware	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Florida	0.90 kg VOC/liter of coating solids applied
Georgia	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds (5.06 lb VOC/gal of coating solids delivered to the applicator)
Hawaii	0.90 kg VOC/liter of coating solids applied
Illinois	air dried coatings - 0.34 kg/liter (2.8 lb/gal), baked coatings - 0.28 kg/liter (2.3 lb/gal)
Iowa	0.90 kg VOC/liter of coating solids applied
Indiana	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds

SUMMARY OF REGULATIONS BY STATE

STATE	METAL FURNITURE SURFACE COATING LIMITS
Kansas	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Kentucky	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds or no more than 15 percent by weight of net input VOC discharged
Louisiana	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Maine	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Massachusetts	5.1 lb VOC/gal of solids applied, daily weighted average on an individual coating line
Michigan	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds or 8.4 lbVOC/gal of applied coating solids
Minnesota	0.90 kg VOC/liter of coating solids applied
Missouri	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Nebraska	VOC ambient air quality standard - 235 micrograms/cubic meter (0.12ppm) as a maximum 1-hour concentration not to be exceeded more than one day a year
Nevada	0.90 kg VOC/liter of coating solids applied
New Hampshire	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
New Jersey	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
New York	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
North Carolina	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
North Dakota	0.90 kg VOC/liter of coating solids applied

SUMMARY OF REGULATIONS BY STATE

STATE	METAL FURNITURE SURFACE COATING LIMITS
Ohio	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds or 5.1 lb VOC/gal if a control system is employed (specific criteria for control system)
Oklahoma	seven coating types with range of limits 4.8-6.5 lb VOC/gal of coating, excluding water, delivered to applicator, Tulsa County has separate limits
Oregon	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Pennsylvania	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Rhode Island	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds, equivalent to 5.06 lb VOC/ gal solids
South Carolina	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Tennessee	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Texas	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Utah	0.3 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Vermont	Daily weighted average limit of VOC content to 3.5 lb VOC/gal or less of coating, as applied, excluding water and exempt compounds
Virginia	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
West Virginia	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Wisconsin	0.36 kg VOC/liter coating (3.0 lb/gal), excluding water and exempt compounds
Wyoming	0.90 kg VOC/liter of coating solids applied

APPENDIX D

APPLICABLE METAL FURNITURE PRODUCT GROUPS

TABLE D-1. METAL FURNITURE PRODUCT GROUPS AND MANUFACTURING SIC CODES

Title	Product Description	Relevant SIC Code
Metal Household Furniture	Bookcases, Chairs, Tables, Swings, Kitchen Cabinets, Medical Cabinets, Camp Furniture, Frames for Boxsprings, Cribs, Cots, Garden Furniture, Serving Carts	2514
Office Furniture, Except Wood	Bookcases, Chairs, Tables, Desks, File Cabinets, Wall Cases, Partitions, Modular Furniture, Benches	2522
Public Building and Related Furniture	Benches, Portable Bleacher Seating, Stadium Seating, Theater Seating, School Furniture, Church Furniture	2531
Office and Store Fixtures, Partitions, Shelving, and Lockers, Except Wood	Cabinets, Counters, Display Cases, Display Fixtures, Bar Fixtures, Shelving, Showcases, Sorting Racks, Lunchroom Fixtures	2542

TABLE D-2. RELATED METAL FURNITURE PRODUCT GROUPS AND MANUFACTURING SIC CODES

Title	Product Description	SIC Code
Furniture and Fixtures, Not Elsewhere Classified	Hospital Beds, Bowling Center Furniture, Cafeteria Furniture, Factory Furniture, Ship Furniture, Restaurant Carts	2599
Hardware, Not Elsewhere Classified	Furniture Hardware, Convertible Bed Mechanisms	3429
Metal Stampings, Not Elsewhere Classified	Wastebaskets, Stamped Metal	3469
Wire Springs	Furniture Springs, Spring Units for Seats	3495
Fabricated Metal Products, Not Elsewhere Classified	Metal Chair Frames, Metal Furniture Parts	3499
Residential Electric Lighting Fixtures	Chandeliers (Residential), Floor Lamps, Lamps (Residential), Wall Lamps, Desk Lamps, Lamp Shades (Metal), Table Lamps	3645
Commercial, Industrial, and Institutional Electric Lighting Fixtures	Chandeliers (Commercial), Desk Lamps	3646
Laboratory Apparatus and Furniture	Laboratory Furniture, Benches, Tables, Cabinets	3821
Dental Equipment and Supplies	Dental Cabinets, Dentists' Chairs	3843
Manufacturing Industries, Not Elsewhere Classified	Beauty Shop and Barber Shop Furniture	3999
Reupholstery and Furniture Repair	Furniture Repair/Refinishing, Antique Repair Restoration	7641

TABLE D-3. METAL FURNITURE PRODUCT DESCRIPTIONS AND CORRESPONDING SIC AND NAICS CODES

Product Description	1987 SIC Code	Equivalent 1997 NAICS Code	Equivalent 1997 NAICS Product Description
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	33636	Motor Vehicle Fabric Accessories and Seat Manufacturing
		337127	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	337127	Institutional Furniture Manufacturing
Hardware, Not Elsewhere Classified	3429	332951	Hardware Manufacturing
Metal Stampings, Not Elsewhere Classified (Except Kitchen Utensils, Pots and Pans for Cooking and Coins)	3469	332116	Metal Stamping
Wire Springs	3495	332612	Wire Spring Manufacturing
Fabricated Metal Products, Not Elsewhere Classified	3499	337215	Showcase, Partition, Shelving, and Locker Manufacturing

TABLE D-3. METAL FURNITURE PRODUCT DESCRIPTIONS AND CORRESPONDING SIC AND NAICS CODES (CONTINUED)

Product Description	1987 SIC Code	Equivalent 1997 NAICS Code	Equivalent 1997 NAICS Product Description
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
Dental Equipment and Supplies	3843	339114	Dental Equipment and Supplies Manufacturing
Manufacturing Industries, Not Elsewhere Classified	3999	337127	Institutional Furniture Manufacturing
		335121	Residential Electric Lighting Fixture Manufacturing
Reupholster and Furniture Repair	7641	81142	Reupholstery and Furniture Repair