U.S ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING & STANDARDS
EMISSION STANDARDS DIVISION
RESEARCH TRIANGLE PARK, NC 27711

COVER SHEET

DATE: 9/17/98

TO: Persons interested in the development of the Metal Furniture Integrated Rule

FROM: **Dr. Mohamed Serageldin**

VOICE PHONE: **919-541-2379**

FAX PHONE: **919-541-5689**
e-mail: serageldin.mohamed@ epamail.epa.gov

OFFICE: U.S ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING & STANDARDS
EMISSION STANDARDS DIVISION
RESEARCH TRIANGLE PARK, NC 27711

MESSAGE:
RE: Metal Furniture Integrated Rule Development

Attached is a copy of the industry questionnaire sent to eight metal furniture manufacturing companies in June 1997.

SURFACE COATING OF METAL FURNITURE
PRESUMPTIVE MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY (P-MACT)
AND PRESUMPTIVE BEST AVAILABLE CONTROLS (P-BAC)
STANDARDS DEVELOPMENT INFORMATION REQUEST
U.S. Environmental Protection Agency
June 1997

The following questions are intended to assist the U.S. EPA in assessing current practices to reduce emissions of hazardous air pollutant (HAP) and volatile organic compound (VOC) material in metal furniture manufacturing operations. If your company owns or operates multiple facilities, please provide a separate response for a minimum of three of these facilities. The EPA requests that Metric units be used for all data reporting. Attachment A contains factors for converting between English and Metric units.

Please return your response by July 10, 1997, to the following address:

Bruce C. Jordan, Director
Emission Standards Division (MD-13)
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

A. General Facility Information

1) Facility name

2) Complete address/Contact person/Phone number

3) Name(s) of legal owner/operator

4) Employment (a - cleaning/pretreatment/coating, b - all production, c - facility total)

5) Product(s) manufactured and applicable SIC code(s)

6) Days/hours of operation

7) Production rate for each product (average and maximum completed assemblies per year)

8) Date of facility construction

B. **Unit Operations**

1) Provide a detailed process description and flow diagram of product flow through the plant, clearly indicating cleaning/pretreatment and coating operations and HAP/VOC emission points. Identify specific HAP and VOC where known. An example process flow diagram is included as Attachment B.

2) Types of pieces coated and substrate material(s) (e.g., aluminum chair frames, steel file cabinets, etc.)

3) List of all coatings used [manufacturer, ID number, type, color, density, solids and organic solvent content (% by mass), usage (kg/yr)]

4) Coating application methods (cross-referenced to process flow diagram, pieces coated, and specific coatings used as listed in items B1 through B3). Be specific -- e.g., electrostatic spray, HVLP, etc.

5) Are pre-coated sheets, coils, or parts used at the facility? If so, what percentage of all parts (in terms of surface area) are pre-coated?

6) Describe solid and liquid waste handling procedures at the facility.

C. **Control Measures and Applicable Regulations**

1) What HAP or VOC emission limitations (operating permit and regulatory) apply to the facility?

2) Describe all measures in use to reduce HAP/VOC emissions (coating substitution, process changes, control devices, etc.). For each, list the year implemented and describe the previous scenario and the emission reduction achieved by the measure. Provide the most recent source test results for any control devices. For any pollution prevention program or innovative emission reduction measures implemented (e.g., as part of EPA’s 33/50 program or other toxic release reduction initiatives), please describe each measure using the UOS approach described in Section E of this questionnaire.

3) Describe any measures in effect to minimize waste at the facility.

D. **Other Information**

The focus of this survey is metal furniture operations. However, the EPA is also requesting information on collocated sources that are not associated with metal furniture operations. Please indicate the existence of collocated sources and estimate the relative emissions of each such source. A collocated source is defined as a source (other than a metal furniture source) located on contiguous or adjacent property that is under common control, including properties that are separated by a road or other public right-of-way. Also indicate what percentage of your facility's overall emissions is associated with metal furniture operations and what percentage is associated with collocated sources.

In your response to this questionnaire, you may aggregate emissions from small sources. However, the operations aggregated must be listed.

Please provide copies of material safety data sheets (MSDS) and product data sheets (if available) for major use coatings, thinners, and solvents.

Provide any other information that could help the EPA in determining HAP and VOC emissions from metal furniture manufacturing facilities and in evaluating the emission reduction measures currently in effect.

E. **Unit Operation System Diagrams**

Emissions and material use data are being collected using the *unit operation system (UOS)* approach.[1] For the purpose of identifying and quantifying the possible sources of pollution, a plant (or facility) is 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 unit operation system means the ensemble on which the material balance is performed. If the purpose of the material balance is to determine emissions due to the coating of metal parts, for example, it encompasses all possible points and sources leading to evaporative emission losses associated with each primary *unit operation*, including

---

[1] "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.

losses during coating application, flashoff from the coated part itself, and from the oven or final drying area.

Attached are examples of several potential UOS's (Attachment C). Figure 1 reflects a metal cleaning and pretreatment operation, Figure 2 shows coating preparation, and Figure 3 shows coating application and drying. We have developed these generic figures to the best of our ability, realizing that individual facilities have a range of production approaches. Please modify these example UOS diagrams (or create new diagrams as necessary) to reflect the actual HAP- or VOC-emitting processes at the facility. For each UOS, indicate the time rate of both HAP and VOC entering and leaving the UOS (e.g., kg/hr), as well as the coating coverage rate (e.g., m^2/hr). In the examples, F and L reflect liquid or solid materials, while V indicates volatile emissions. For the purpose of responding to this questionnaire, please apportion the total emissions among the individual volatile emission points to the best of your ability.

Provide one diagram for each separate UOS at the facility. For the metal cleaning/pretreatment operation, prepare a separate HAP/VOC diagram for <u>each</u> tank or stage of the entire process (i.e., separate diagrams for cleaning, water rinse, surface etching, etc.). Operations or individual stages of an operation with no HAP or VOC emissions should be indicated on the overall facility process diagram, but they do not need a UOS diagram.

Draft definitions of several terms are included in Attachment D, and a list of HAP is provided in Attachment E.

ATTACHMENT A

Metric Conversion Factors

CONVERSION FACTORS FOR METRIC UNITS

In keeping with U.S. Environmental Protection Agency policy, metric units should be used in your response. These units may be converted to common English units by using the following conversion factors:

Metric Unit	Metric Name	Equivalent English Unit
1 m	meter	3.2808 ft (feet)
2.54 cm	centimeter	1 in. (inch)
0.0283 m^3	cubic meter	1 ft^3 (cubic foot)
liter	liter	0.0353 ft^3
dscm	dry standard cubic meter	35.31 dry standard ft^3
scmm	standard cubic meters per minute	35.31 ft^3/min
kg	kilogram (10^3 grams)	2.2046 lb (pound)
Mg	megagram (10^6 grams)	2,204.6 lb
metric ton	metric ton (10^6 grams)	2,204.6 lb
1 m^3	cubic meter	264.17 gallons
3.785 liters	liters	1 gallon
1.054 kJ	kilojoule	1 Btu (British Thermal Unit)
1.054 X 10^6 kJ	kilojoule	MMBtu
3514 J/s	Joules per second	1 ton (or 12,000 Btu/hr)
16.02 kg/m^3	kilograms per cubic meter	1 lb/ft^3 (pounds/cubic foot)

T (°F)=temperature in degrees Fahrenheit
T (°C)=temperature in degrees Celsius or degrees Centigrade

▸Temperature in degrees Celsius (°C) can be converted to temperature in degrees Fahrenheit (°F) by the following formula:

$$T\ (°F) = 1.8\ T\ (°C) + 32$$

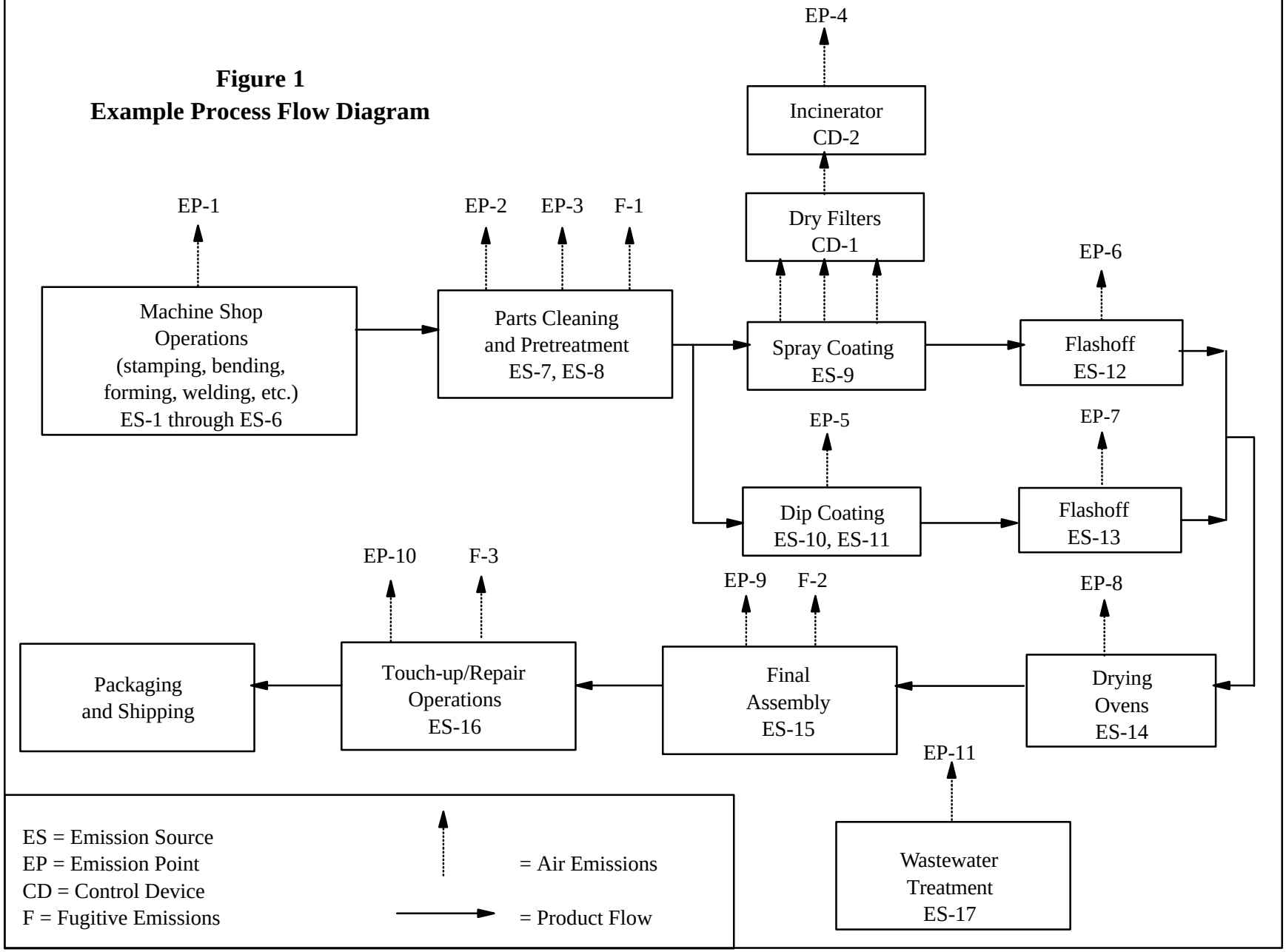
▸Temperature in degrees Fahrenheit (°F) can be converted to temperature in degrees Celsius (°C) by the following formula:

$$T\ (°C) = [T\ (°F) - 32]/1.8$$

ATTACHMENT B

Example Process Flow Diagram

Figure 1
Example Process Flow Diagram



ATTACHMENT C

Example Unit Operation System (UOS) Diagrams

Figure 1. Cleaning/Pretreatment UOS

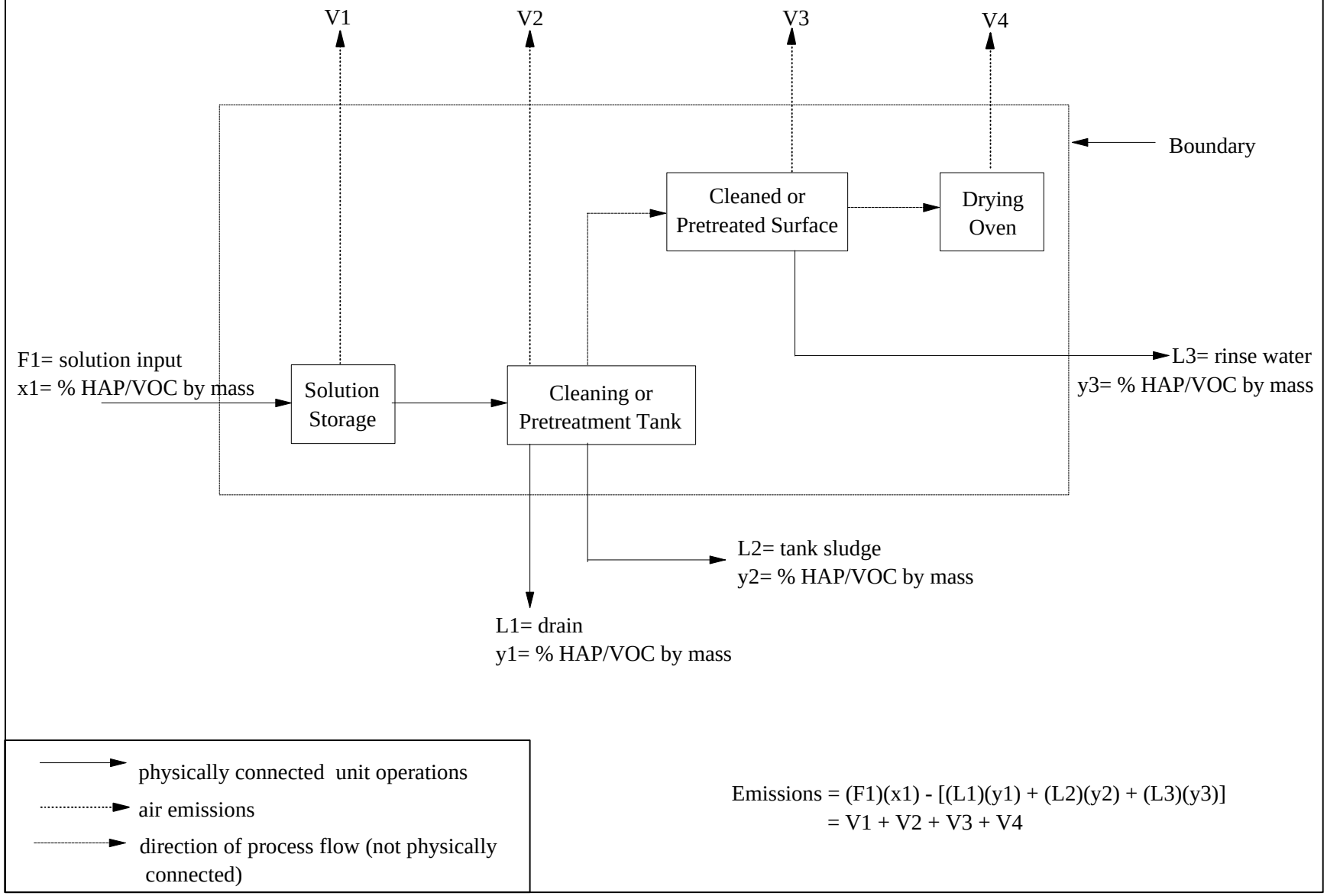
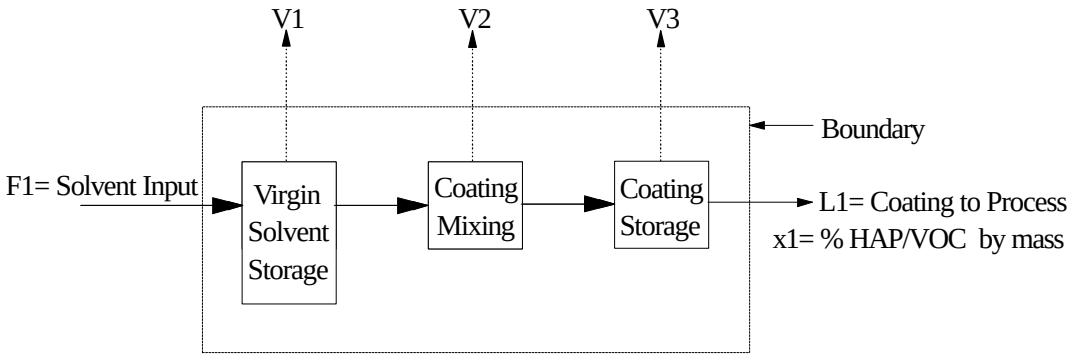
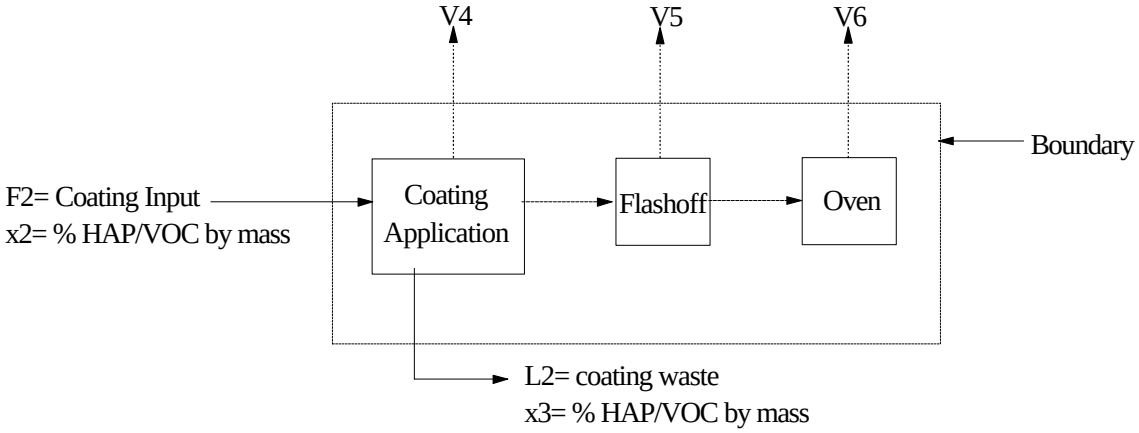


Figure 2. Coating Preparation UOS (Primer or Topcoat)

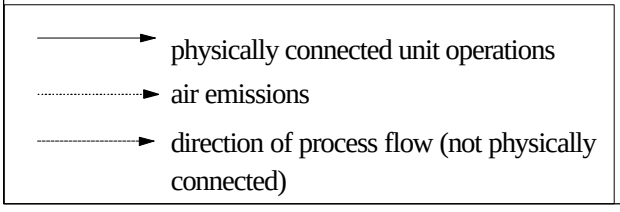


Emissions = F1-(L1)(x1) = V1 + V2 + V3

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



Emissions = (F2)(x2) - (L2)(x3) = V4 + V5 + V6



ATTACHMENT D

Draft Definitions

Draft Definitions
(Revised February 9, 1997)

Abatement or recovery device (see Add-on control device)

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.

Add-on control device efficiency means the ratio of the emissions collected or destroyed by an add-on air pollution control device to the total emissions that are introduced to the control device, expressed as a percentage.

Administrator means the Administrator of the United States Environmental Protection Agency (U.S. EPA) or his or her authorized representative.

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.

Alternative method means any method of sampling and analyzing for an air pollutant that is not a reference or equivalent method but has been demonstrated to the Administrator's satisfaction to, in specific cases, produce results adequate for a determination of compliance.

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

As-supplied means the condition of a coating before any thinning, as sold and delivered by the coating manufacturer to the user.

BAC means Best Available Controls.

Baseline conditions means the conditions that exist prior to an affected source implementing controls, such as a control system.

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.

Capture efficiency means the fraction of all organic vapors, HAP emissions, or other pollutants generated by a process that are directed to an add-on air pollution control device expressed as a percentage.

Capture system means a hood, enclosed room, of other means of collecting organic HAP emissions into a closed-vent system that exhausts to a control device.

Captured emissions means all emissions that are delivered to a control device.

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

Cleaning activity means the physical removal of foreign material from the substrate being cleaned. Includes actions such as wiping, brushing, flushing, or spraying applied within an operation.

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 operations means operations, such as, spray-gun and flush cleaning operations, in which organic solvent is used to remove coating materials or adhesives from equipment used in coating manufacturing operations.

Cleaning solvent means a liquid material used for hand-wipe, spray gun, or flush cleaning. This definition does not include solutions that contain no VOC.

Closed-loop recycling (in-process recycling) means the reuse or recirculation of a chemical material within the boundaries used to develop a material balance around a "unit operation system." A recovery or reclamation (R or R) unit operation may be within the boundaries selected for the primary unit operation system if it is:

1. <u>Solely dedicated</u>. The chemical is reused only for cleaning the primary unit operation.

2. Physically integrated. The R or R operation is connected to the primary unit operation by means of piping, so that it is not possible to perform the material balance around the primary unit operation system without including it.

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

Coating means a protective, decorative, or functional film applied as a thin layer to a substrate or surface and which cures to form a continuous solid film (see Primer, Topcoat). This term often applies to paints such as lacquers or enamels, but also is used to refer to films applied to paper, plastics, or foil.

Coating application means the process by which the coating mix 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 rule, 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 determined using data from EPA Method 24, or an equivalent or alternative method.

Coating station means a work station on which a coating operation is conducted.

Compliant coating means a coating whose volatile organic compound or hazardous air pollutant content does not exceed that allowed by regulation. Compliant coatings may be waterborne, low solvent (higher solids), or powder.

Control in the air pollution field 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 efficiency (see Add-on control device efficiency)

Control system means the combination of capture systems and add-on control devices used to reduce emissions to the atmosphere. For example, 100% capture efficiency and 95% destruction efficiency amounts to 95% control.

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.

Criteria pollutant means a pollutant for which a criteria document has been issued as described by section 108 of the Clean Air Act. Criteria pollutants are nitrogen oxides, sulfur dioxides, ozone, particulate matter, and carbon monoxide. A National Ambient Air Quality Standard (NAAQS) exists for each criteria pollutant.

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 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 control system means a combination of capture system and add-on control device used to reduce emission to the atmosphere. System efficiency is the product of capture efficiency and destruction efficiency (e.g., 95% capture efficiency X 95% destruction efficiency = 90% overall efficiency).

Emission reduction means the decrease in HAP or VOC material emitted when (1) a low solvent containing coating is used in

place of a higher solvent containing coating or (2) an add-on control device (such as a carbon adsorber or incinerator) is used. Emission reduction is often expressed as a percentage.

Equivalent method means any method of sampling and analyzing for an air pollutant that has been demonstrated to the Administrator's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specific conditions.

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.

Face velocity means the velocity of air through a paint spray booth. Where people are working, health regulations usually require this velocity to be at least 30.5 meters per minute (100 feet per minute). When electrostatic spraying is used a face velocity of 18 meters per minute (60 feet per minute) is permitted.

Faraday Cage Effect means a condition that may exist on a substrate due to its geometric configuration that may inhibit the electrostatic application of powder particles at that specific localized area, such as cavities or recesses.

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 former means the part of a coating that remains on the substrate after the cure (nonvolatiles). Some film formers may be liquid but polymerize to form a solid when coating is baked to the requisite curing temperature.

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.

Flow coating means a method of applying coating in which the coating is poured onto the part.

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

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

Higher-nonvolatiles (solids) 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 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.

Hood or enclosure means devices used to capture emissions and direct them to an abatement or recovery device.

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.

Manufacturer's formulation means a list of substances or component parts of coatings as described by the maker of the coatings.

Mass percent solids means the portion of a coating which remains as part of the cured film expressed as percent by weight. This contrasts to another convention of expressing content by volume percent.

Material balance means a calculation based on conservation of mass (i.e., the mass of material going into a process is equal to the mass of material which leaves the process). This relationship is often used to estimate solvent losses from coating operations.

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 means the film-forming material of a coating; also termed solids.

Offsite recycling means a recovery or reclamation unit operation system located outside of the plant boundaries.

Onsite recycling means a recovery or reclamation unit operation located within the plant boundaries from which the recycled material is returned to a process other than that which generated the waste material.

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

Permanent total enclosure means a permanently installed enclosure that completely surrounds a source of emissions such that all emissions are captured and contained for discharge through a control device. For additional information, see Guidelines for Determining Capture Efficiency, January 1994. (Docket No. A-93-10, Item No. IV-B-1).

Photochemical reactivity means the measure of the rate at which an organic compound reacts in the presence of ultraviolet radiation to form photochemical oxidants.

Pigmented means containing finely ground insoluble powder dispersed to give a characteristic color.

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.

Powder coating means a coating applied as a dry powder which, when baked at sufficiently high temperature, flows out to form a continuous film. Powder coatings may emit VOC/HAP cure volatiles.

Primer means the first layer or layers of identically formulated coating applied to a surface, usually prior to the subsequent application of a topcoat.

Primary heat recovery means a method of conserving energy by using heat from incinerator exhaust gases to preheat the inlet gas to the incinerator.

Process (process line) means the sum of unit operations that result in the production of individual or groups of products.

Process fugitives means air emissions emanating from the process line that are not captured.

Product substitution means replacement of any product or raw material intended for an intermediate or final use with another. This substitution is a source reduction activity if either the VOC emissions or the quantity of waste generated at the source is reduced.

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.

Reclaim means a material that is processed or regenerated to recover a usable product (see recycle).

Recovered solvent means solvent which is extracted from a process or exhaust stream usually by adsorption or condensation.

Recovery or regeneration (R or R) unit operation means a device for purifying solvent that may use any of a variety of techniques, including extraction, distillation, filtration, adsorption, or absorption.

Recycled means used, reused, or reclaimed (40 CFR 261.1(b)(7)). A material is "used or reused" if it is employed as an ingredient (including its use as an intermediate) to make a product. For example, when solvent recovered by distillation is reused in the plant.

Rework means touch-up (see touch-up and repair operation) that is performed after the part has been cured.

Secondary heat recovery means the use of heat from an incinerator exhaust for uses within a plant such as heating an oven or a room. This is distinguished from primary heat recovery which is the use of the hot incinerator exhaust gases to heat the inlet gases to the incinerator.

SIC code means Standard Industrial Classification, a numerical identification system developed by the U.S. Government for statistical purposes and widely used by business firms. Industries are grouped into similar categories and each category is given a number representing the category.

Solids (see nonvolatiles or coating solids)

Solvent means a liquid used in a coating to dissolve or disperse constituents and/or to adjust viscosity. It generally evaporates during drying and, therefore, does not become part of the dried film.

Solventborne coating means a coating that contains only organic solvents. If water is present, it is only in trace quantities.

Solvent recovery device means, for the purposes of this subpart, an add-on control device in which HAP material is captured rather than destroyed. Examples include carbon adsorption systems and condensers.

Source reduction (or pollution prevention) means any activity or treatment that reduces or eliminates the generation of VOC/HAP emissions (or waste) at the source of pollution, including product substitution or elimination.

Stack means a contained air stream (excluding storage tanks), which is a point through which emissions exit the facility.

Surface coating operation means the application of a film which covers the surface of an object. Painting and varnishing are common surface coating operations as are coatings applied to large appliance, metal furniture, fabric, paper, plastic film, and metallic foil.

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.

Temporary total enclosure means an enclosure that meets the requirements of §63.805(e)(1)(i) through (iv) and is not permanent, but constructed only to measure the capture efficiency of pollutants emitted from a given source. Additionally, any exhaust point from the enclosure shall be at least four equivalent duct or hood diameters from each natural draft opening. For additional information, see Guidelines for Determining Capture Efficiency, January 1994. (Docket No. A-93-1, Item No. IV-B-1).

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.

Thinning solvent means a solvent added to thin a coating for the purpose of lowering the coating’s viscosity and that evaporates before or during the cure of a film.

Thinning ratio means the volumetric ratio of thinner to coating.

Threshold Limit Values (TLV) means the air concentrations of chemical substances to which it is believed that workers may be exposed without adverse effect.

Topcoat means a coating applied to a bare substrate or over a primer to provide protective and/or decorative properties to a part.

Total enclosure means an enclosure around the coating head of a wet coating line or other coating application device so that all HAP and VOC from the coating application and flash off operations are collected and ducted through a stack or into the oven. With a total enclosure on a coating line there will be no fugitive emissions, only stack emissions. Some air pollution regulations may require a total enclosure so that all HAP and VOC emitted by the process can be measured. The only openings in a total enclosure are forced makeup air and exhaust ducts and any natural draft openings such as those that allow raw materials to enter and exit the enclosure for processing. All access doors or windows are closed during routine operation of the enclosed source. Brief, occasional openings of such doors or windows to accommodate process equipment adjustments are acceptable, but if such openings are routine or if an access door remains open during the entire operation, the access door must be considered a natural draft opening. The average inward face velocity across the natural draft openings of the enclosure must be calculated including the area of such access doors. The drying oven itself may be part of the total enclosure. An enclosure that meets the requirements found in §63.750(g)(4) is a permanent total enclosure.

Touch-up and repair operation means that portion of the coating operation that is the incidental application of coating used to cover minor imperfections in the coating finish or to achieve complete coverage. This definition includes out-of-sequence or out-of-cycle coating.

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 on which the material balance is performed.

Viscosity means a measure of a coating's resistance to flow.

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 solvent.

Volume percent solids means the portion of a coating which remains as part of the cured film expressed as percent by volume. This contrasts to another convention of expressing solids content by mass percent. Often a percentage is given without specifying whether volume or mass. This is confusing and leads to errors in coating calculations.

Waste handling means processing or treatment of waste (liquid or solid) that is generated as a by-product of either the coating process or cleaning activities/operations.

Waste handling device means equipment that is used to separate solvent from solid waste (e.g., filter dryers) or liquid (e.g., pot stills and thin film evaporators). The solvents are recovered by heating, condensing, and collection.

Waste management means the handling, treatment, storage, and disposal of solid or liquid waste products.

Waste minimization means the reduction, to the extent feasible, of hazardous waste that is generated or subsequently treated, stored or disposed. It includes any source reduction or recycling activity undertaken by a generator that results in either the reduction of total volume or quantity of hazardous waste, or both, so long as reduction is consistent with the goal of minimizing present and future threats to human health and the environment. In order of preference, these activities include: source reduction, recycling, and treatment.

Wastewater discharge means the water phase that is discharged from the separator in a wastewater treatment system.

Waterborne coating means a coating that contains more than 5 percent by mass water in its volatile fraction.

Work practice means specific human activities within industry that lead to a reduction in VOC emissions (or waste). The activities include increased operator training, management directives, segregation of waste solvent, and practices that lead to a reduction in cleaning frequency. It does not include the use of specialized equipment, such as solvent dispensers.

ATTACHMENT E

List of Hazardous Air Pollutants

List of Hazardous Air Pollutants

CAS No.	Chemical Name	CAS No.	Chemical Name
75070	Acetaldehyde	132649	Dibenzofurans
60355	Acetamide	96128	1,2-Dibromo-3-chloropropane
75058	Acetonitrile	84742	Dibutylphthalate
98862	Acetophenone	106467	1,4-Dichlorobenzene(p)
53963	2-Acetylaminofluorine	91941	3,3-Dichlorobenzidene
107028	Acrolein	111444	Dichloroethyl ether (Bis(2-
79061	Acrylamide	542756	1,3-Dichloropropene
79107	Acrylic acid	62737	Dichlorvos
107131	Acrylonitrile	111422	Diethanolamine
107051	Allyl chloride	121697	N,N-Diethyl aniline (N,N-
92671	4-Aminobiphenyl	64675	Diethyl sulfate
62533	Aniline	119904	3,3-Dimethozybenzidine
90040	o-Anisidine	60117	Dimethly aminoazobenzene
1332214	Asbestos	119937	3,3'-Dimethyl benzidine
71432	Benzene (including benzene from	79447	Dimethyl carbamoyl chloride
92875	Benzidine	68122	Dimethyl formamide
98077	Benzotrichloride (isomers and	131113	Dimethyl phthalate
100447	Benzyl chloride	77781	Dimethyl sulfate
92524	Biphenyl	534521	4,6-Dinitro-o-cresol, and salts
117817	Bis(2-ethylhexyl)pthalate(DEHP)	51285	2,4-Dinitrophenol
542881	Bis(chloromethyl)ether	121142	2,4-Dinitrotoluene
75252	Bromoform	123911	1,4-Dioxane (1,4-Diethyleneoxide)
106990	1,3-Butadiene	122667	1,2-Diphenylhydrazine
156627	Calcium cyanamide	106898	Epichlorohydrin (1-Chloro-2,3-
133062	Captan	106887	1,2-Epoxybutane
63252	Carbaryl	140885	Ethyl acrylate
75150	Carbon disulfide	100414	Ethyl benzene
56235	Carbon tetrachloride	51796	Ethyl carbamate (Urethane)
43581	Carbonyl sulfide	75003	Ethyl chloride (Chloroethane)
120809	Catechol	106934	Ethylene dibromide (Dibromoethane)
133904	Chloramben	107062	Ethylene dichloride (1,2-
57749	Chlordane	107211	Ethylene glycol
7782505	Chlorine	151564	Ethylene imine (Aziridine)
79118	Chloracetic acid	75218	Ethylene oxide
532274	2-Chloroacetophenone	96457	Ethylene thiourea
108907	Chlorobenzene	75343	Ethylene dichloride (1,1-
510156	Chlorobenzilate	50000	Formaldehyde
67663	Chloroform	76448	Heptachlor
107302	Chloromethyl methyl ether	118741	Hexachlorobenzene
126998	Chloroprene	87683	Hexachlorobutadiene
1319773	Cresols/Cresylic acid	77474	Hexachlorocyclopentadiene
95487	o-Cresol	67721	Hexachloroethane
108394	m-Cresol	822060	Hexamethylene-1,6-diisocyanate
106445	p-Cresol	680319	Hexamethylphosphoramide
98828	Cumene	110543	Hexane
94757	2,4-D, salts and esters	302012	Hydrazine
3547044	DDE	7647010	Hydrochloric acid
57147	1,1-Dimethyl hydrazine	7664393	Hydrogen fluoride (Hydrofluoric
334883	Diazomethane	123319	Hydroquinone
78591	Isophorone	1336363	Polychlorinated biphenyls

CAS No.	Chemical Name
58899	Lindane (all isomers)
108316	Maleic anhydride
67561	Methanol
72435	Methoxychlor
74839	Methyl bromide (Bromomethane)
74873	Methyl chloride (Chloromethane)
71556	Methyl chloroform (1,1,1-
78933	Methyl ethyl ketone (2-Butanone)
60344	Methyl hydrazine
74884	Methyl iodide (Idomethane)
108101	Methyl isobutyl ketone (Hexone)
624839	Methyl isocyanate
80626	Methyl methacryalate
1634044	Methyl tert butyl ether
101144	4,4-Methylene bis(2-chloroaniline)
75092	Methylene chloride
101688	Methylene diphenyl diisocyanate
101779	4,4-'Methylenedianiline
91203	Naphthalene
98953	Nitrobenzene
92933	4-Nitrobiphenyl
100027	4-Nitrophenol
79469	2-Nitropropane
684935	N-Nitroso-N-methylurea
62759	N-Nitrosodimethylamine
59892	N-Nitrosomorpholine
56382	Parathion
82688	Pentachloronitrobenzene
87865	Pentachlorophenol
108952	Phenol
106503	p-Phenylenediamine
75445	Phosgene
7803512	Phosphine
7723140	Phosphorus
85449	Phthalic anhydride

CAS No.	Chemical Name
1120714	1,3-Propane sultone
57578	beta-Propiolactone
123386	Propionaldehyde
114261	Propoxur (Baygon)
78875	Propylene dichloride (1,2-
75569	Propylene oxide
75558	1,2-Propylenimine (2-Methyl
91225	Quinoline
106514	Quinone
100425	Styrene
96093	Styrene oxide
1746016	2,3,7,8-Terachlorodi-benzo-p-
79345	1,1,2,2-Tetrachloro-ethane
127184	Tetrachloroethylene
7550450	Titanium tetrachloride
108883	Toluene
95807	2,4-Toluene diamine
584849	2,4-Toluene diisocyanate
95534	o-Toluidine
8001352	Toxaphene (chlorinated camphene)
120821	1,2,4-Trichlorobenzene
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
95954	2,4,5-Trichlorophenol
88062	2,4,6-Trichlorophenol
121448	Triethylamine
1582098	Trifluralin
540841	2,2,4-Trimethylpentane
108054	Vinyl acetate
593602	Vinyl bromide
75014	Vinyl chloride
75354	Vinylidine chloride (1,1-
1330207	Xylenes (isomers and mixtures)
95476	o-Xylenes
108383	m-Xylenes
106423	p-Xylenes

CAS No.	Chemical Name
0	Antimony Compounds
0	Arsenic Compounds (inorganic including arsine)
0	Beryllium Compounds
0	Cadmium Compounds
0	Chromium Compounds
0	Cobalt Compounds
0	Coke Oven Emissions
0	Cyanide Compounds[a]
0	Glycol Ethers[b]
0	Lead Compounds
0	Manganese Compounds
0	Mercury Compounds
0	Fine mineral fibers[c]
0	Nickel Compounds
0	Polycylic Organic Matter[d]
0	Radionuclides (including radon)[e]
0	Selenium Compounds

NOTE: For all listings above which contain the word “compounds” and for gylcol ethers, the following applies: Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc.) as part of that chemical’s infrastructure.

[a] X'CN where X = H' or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$.

[b] Includes mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol

$R-(OCH_2CH_2)_n-OR'$ where

n = 1, 2, or 3

R = alkyl or aryl groups

R'= R, H, or groups which, when removed, yield glycol ethers with the structure: $R-(OCH_2CH)_n-OH$

Polymers are excluded from the glycol category

[c] Includes glass microfibers, glass wool fibers, rock wool fibers, and slag wool fibers, each characterized as “respirable” (fiber diameter less than 3.5 micrometers) and possessing an aspect ratio (fiber length divided by fiber diameter) greater than or equal to 3, as emitted from production of fiber and fiber products.

[d] Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100°C.

[e] A type of atom which spontaneously undergoes radioactive decay.