MEMORANDUM

TO: Urban Strategy Docket

FROM: Barbara Driscoll

DATE: November 18, 2002

SUBJECT: Description of New Source Categories that are Listed for Future Regulatory Development

---

This memo was developed to define the new source categories that are listed for future regulatory development in the Urban Area Toxics program. The source categories listed for regulation consist of the following groups:

1. Asphalt Processing and Asphalt Roofing Manufacturing
2. Brick and Structural Clay Products Manufacturing
3. Carbon Black Production
4. Chemical Manufacturing: Chromium Compounds
5. Chemical Preparations
6. Clay Ceramics Manufacturing
7. Copper Foundries
8. Electrical and Electronic Equipment: Finishing Operations
9. Fabricated Plate Work
10. Fabricated Metal Products Manufacturing, Not Elsewhere Classified
11. Fabricated Structural Metal Manufacturing
12. Ferroalloys Production: Ferromanganese and Silicomanganese
13. Heating Equipment Manufacturing, Except Electric
14. Industrial Machinery and Equipment: Finishing Operations
15. Inorganic Pigments Manufacturing
16. Iron and Steel Forging
17. Nonferrous Foundries, Not Elsewhere Classified
18. Paints and Allied Products Manufacturing
19. Plastic Parts and Products (Surface Coating)
20. Prepared Feeds Manufacturing
21. Primary Copper Smelters
22. Primary Metals Products Manufacturing
23. Valves and Pipe Fittings

The source categories cover only area sources. Section 112 of the Clean Air Act defines an area source as any stationary emission source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit, considering controls in the aggregate, less than 10 tons per year of the 188 regulated hazardous air pollutants and less than 25 tons per year of any combination of hazardous air pollutants.

The definitions for the source categories were developed from readily available information including the 1996 National Toxics Inventory and the 1987 Standard Industrial Classification Manual. Other sources of information included the Environmental Protection Agency web site and other sources on the Internet.

This set of definitions does not mean that EPA will regulate all of these sources. These draft definitions are only a beginning point, and a separate description will be developed during the regulatory process.

1. Asphalt Processing and Asphalt Roofing Manufacturing

NAICS: 324121, Asphalt Paving, Mixture, and Block Manufacturing

324122, Asphalt Shingle and Coating Materials Manufacturing

32412, Asphalt Paving, Roofing, and Saturated Materials Manufacturing

32411, Petroleum

SIC: 2951, Asphalt Paving, Mixtures, and Blocks

2952, Asphalt Felts and Coatings

2911, Petroleum Refining

SCC: 305001, Industrial Processes, Mineral Products, Asphalt Roofing Manufacture

305002, Industrial Processes, Mineral Products, Asphalt Concrete

Asphalt processing and asphalt roofing manufacturing operations can be stand-alone or integrated with each other or related operations such as wet-formed fiberglass mat manufacturing. Additionally, some asphalt processing is performed at petroleum refineries.

Processed asphalt is produced using asphalt flux as the raw material. Asphalt flux is a product that is obtained in the last stages of fractional distillation of crude oil. Asphalt is processed to change its physical properties for use primarily in the roofing industry. In asphalt processing, heated asphalt flux is taken from storage and charged to a heated blowing still where air is bubbled up through the flux. This process raises the softening temperature of the asphalt. The blowing process also decreases the penetration rate of the asphalt when applied to the roofing substrate.

Some processing operations use a catalyst (e.g., ferric chloride, phosphoric acid) in the blowing still. A catalyst is used to promote the oxidation of asphalt in the blowing still. The need to use catalyst is primarily driven by the type of feedstock used. Certain feedstocks require catalyst to be used to attain desired product specifications.

In asphalt roofing manufacturing, processed or modified asphalt (also called modified bitumen) is applied to a fibrous substrate (typically made of fiberglass or organic felt) to produce the following types of roofing products: shingles, laminated shingles, smooth-surfaced roll roofing, mineral-surfaced roll roofing, and saturated felt roll roofing. Modified asphalt is asphalt that is mixed with plastic modifiers (which add strength and durability to the asphalt) and is typically used to produce roll roofing products.

A roofing manufacturing line is a largely continuous operation, with line stoppages occurring primarily due to breaks in the substrate. In asphalt roofing manufacturing, asphalt is typically mixed with filler materials before application to the substrate. If a fiberglass substrate is used, coating asphalt is applied by a coater. If an organic substrate is used, a saturator and wet looper are typically used prior to the coater to provide additional time for the asphalt to impregnate the substrate.

The type of final product being manufactured determines the process steps that follow the coating or impregnation steps. For shingles and mineral-surfaced roll roofing, granules are applied to the hot surface of the coated substrate. This step is omitted in manufacture of smooth-surfaced and saturated felt roll roofing. In shingle manufacture, a strip of sealant (typically oxidized or modified asphalt) is applied to the back of the product after it has cooled. This sealant strip, which is heated by the sun after the roofing product is installed, provides some adhesion and sealing between layers of roofing product. In shingle manufacture, the coated substrate is cut into the desired size. Multiple single-ply shingles can be glued together (typically using oxidized or modified asphalt as an adhesive) to produce laminated or dimensional shingles. When asphalt roofing manufacturing lines are collocated with asphalt processing operations, the two operations typically share storage and process tanks.

2. Brick and Structural Clay Products Manufacturing

NAICS: 327121, Brick and Structural Clay Tile Manufacturing

327123, Other Structural Clay Production

SIC: 3251, Brick and Structural Clay Tile (Except Slumped Brick)

3259, Structural Clay Products, NEC

SCC: 305003, Industrial Processes, Mineral Products, Brick Manufacture

The brick and structural clay products (BSCP) source category includes those facilities that manufacture (1) brick (face brick, structural brick, brick pavers); (2) clay pipe; (3) roof tile; (4) quarry tile (extruded floor tile); and (5) other extruded, dimensional clay products. The general process steps used in the production of BSCP include mining, raw material processing, forming, coloring and texturing, cutting or shaping, drying, firing, cooling, storage, and shipping of the final product.

Brick and structural clay products are produced primarily from common clay and shale. The most common metallic additive/surface coating is manganese dioxide. Other hazardous air pollutant (HAP)-containing additives/surface coatings include iron chromite, cobalt oxide, lead, nickel, cadmium, and arsenic. Many facilities have on-site mining operations, while others obtain raw materials by truck or rail from nearby mines. Raw material processing typically includes crushing, grinding, screening, and storage.

After the initial processing, the raw materials are mixed and formed. In some product mixes, metallic additives and other materials are used to add color or texture to the body of the product. The most common forming process is extrusion. After forming, surface coatings are sometimes applied to impart color or texture to the outside of the extruded column, and the column is then cut into individual bricks. The bricks are stacked on kiln cars, held in holding rooms (also called predryers), dried in tunnel dryers that may be stand-alone or may be part of the kilns, and then fired in kilns. Although many facilities operate periodic kilns, the most common type of kiln used in the industry is the tunnel kiln. In tunnel kilns, fired products enter the cooling section of the kiln where they are cooled to near ambient temperatures. The products are then stored and shipped.

3. Carbon Black Production

NAICS: 325182, Carbon Black Manufacturing

SIC: 2895, Carbon Black Manufacturing

SCC: 301005, Industrial Processes, Chemical Manufacturing, Carbon Black Production

30102656, Industrial Processes, Chemical Manufacturing, Synthetic Rubber (Manufacturing only), Fugitive Emissions; Carbon Black Storage

31501003: Industrial Processes, Photographic/Healthcare/Laboratories/Photocopying Equipment Manufacturing, Toner (Carbon Black) Grinding

Carbon black production facilities include plants manufacturing channel and furnace black. Those facilities primarily engaged in manufacturing bone and lamp black are classified under inorganic pigment production. Types of carbon black are classified according to the process by which they were derived, the size distribution of the primary particles, and the degree of the aggregation and agglomeration of the chemicals adsorbed onto the surfaces. Typical chemicals adsorbed onto the surface of carbon black include polycyclic aromatic hydrocarbons (PAHs), nitro derivatives of PAHs, and sulfur-containing PAHs.

Carbon black is used primarily in rubber tires, other automotive products, and other rubber products. Small amounts of carbon black are used in inks, paints, plastics, and the manufacture of dry-cell batteries.

The carbon black source category includes facilities that use the furnace black process, thermal black process, or the acetylene decomposition process. The furnace black process is a closed system thermal-oxidative decomposition process. The thermal black process is a cyclic thermal decomposition process. The acetylene black process is a continuous thermal decomposition process.

A carbon black unit (CBU) consists of the equipment assembled to produce carbon black by either the furnace, thermal, or acetylene decomposition processes. The major components of the CBU include (1) a feedstock and raw materials section consisting primarily of feedstock storage tanks, (2) a production unit section consisting of one or more reactors, (3) a separation section that includes the filters, (4) a pelletization and densification section consisting of wet or dry pelletization equipment and densification, (5) a packaging and storage section that includes final product silos and packaging for pellets and powder, and (6) a shipping section that consists of storage and shipment of the product in bag or bulk form.

In the furnace black process, carbon black is produced via thermal-oxidative decomposition in a closed system. The feedstock consists primarily of aromatic oils based on crude oil. The dry pelletization process differs from the wet process in that it includes a pelletizer and does not utilize a dryer.

In the thermal black process, carbon black is produced via thermal decomposition in a cyclic process. The most commonly used feedstock is natural gas. A typical configuration uses two reactors working in parallel. While one reactor is heating, the second reactor is in the decomposition cycle. Separation of the carbon black from the thermal black process and subsequent processing are similar to the furnace black process.

In the acetylene black process, carbon black is produced via thermal decomposition in a continuous process. The feedstock for this process is acetylene. Separation of the carbon black is similar to the furnace black process. The acetylene black process does not include a pelletization process. The reactor design for the acetylene process is similar to the thermal black process.

4. Chemical Manufacturing: Chromium Compounds

NAICS: 325188, All Other Basic Inorganic Chemical Manufacturing

SIC: 2819, Industrial Inorganic Chemicals, Not Elsewhere Classified

SCC: 30199999, Industrial Processes, Chemical Manufacturing, Other Not Classified

Chemical manufacturing of chromium compounds is included in the classification of establishments primarily engaged in manufacturing industrial inorganic chemicals. There are two main processes in this category, manufacturing sodium bichromate and manufacturing chromic acid.

Sodium bichromate (sodium dichromate dihydrate) is used directly in industrial processing, and as a raw material in the preparation of other chromium chemical compounds. It is the most important member of the chrome family.

The manufacturing process of sodium bichromate begins with chromite ore. To produce raw sodium chromate, ground ore is roasted with soda ash in kilns at very high temperatures. The kiln and product, called a 'roast,' must be quenched and leached of its sodium chromate. Residual iron, aluminum and other oxides are removed by a series of pH adjustments and filtration steps. After impurities are removed, sodium chromate is acidified with sulfuric acid to form sodium bichromate. The solution is then evaporated to 85 percent concentration.

The concentrated bichromate liquor can be stored as a solution and transported by tank car or truck, or it can be crystalized for shipment in bags. The crystals are produced by cooling concentrated sodium bichromate liquor under controlled conditions. The liquor also serves as a building block for chromic acid.

Chromic acid is produced by reacting sodium bichromate liquor with sulfuric acid. The crude crystal from this reaction is filtered and melted under controlled conditions. The molten chromic acid is then cooled, flaked and packaged in a controlled atmosphere.

5. Chemical Preparations

NAICS: 325998, All Other Miscellaneous Chemical Product and Preparation Manufacturing

SIC: 2899, Chemicals and Chemical preparations, NEC; Frit, Table Salt, Fatty Acids, Other

SCC: 30199999, Industrial Processes, Chemical Manufacturing, Other Not Classified

The Chemical Preparations source category includes establishments primarily engaged in manufacturing miscellaneous chemical preparations that are not elsewhere classified, such as fatty acids, essential oils, gelatin (except vegetable), industrial compounds, and chemical supplies for foundries.

Several processes are used in chemical preparation. The wet mixing process includes chemical solutions that are created by mixing liquid components. No reactions occur during the wet mixing process. The dry mixing process includes chemical mixtures that are created by mixing components that are in dry form, such as powders and pellets. No reactions occur during the dry mixing process. Dispensing is a special type of dry mixing. Dry chemicals in powder form are stored in large containers. These containers have spouts that pour into a specialized type of hollowed out wire. The powder is gravity fed into the hollowed out wire, and later the wire is resealed. Some powder may escape into the air while the powder is being fed into the wire. This fugitive powder can contain chromium and nickel. Another chemical preparation process uses a reduction tank where hexavalent chromium is reduced to trivalent chromium. This is a wet process, so the reactants are in liquid form. However, this is not a mixing process since a reaction is occurring in the tank.

6. Clay Ceramics Manufacturing

NAICS: 32711, Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing

327112, Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing

327122, Ceramic Wall and Floor Tile Manufacturing

SIC: 3253, Ceramic Wall and Floor Tile

3261, Vitreous China Plumbing Fixtures and China and Earthenware Fittings and Bathroom Accessories

3262, Vitreous China Table and Kitchen Articles

3263, Fine Earthenware (Whiteware) Table and Kitchen Articles

3269, Pottery Products, Not Elsewhere Classified

3299, Nonmetallic Mineral Products, Not Elsewhere Classified; clay statuary, moldings ornamental and architectural plaster work and gypsum statuary, other nonmetallic mineral products

SCC: 305008, Industrial Processes, Mineral Products, Ceramic Clay/Tile Manufacturing

The clay ceramics manufacturing industry includes facilities that manufacture sanitaryware, tile, dinnerware, and pottery. These products are primarily clay-based, and the manufacturing processes generally include raw material processing, mixing, forming, shape drying, glazing, firing, and finishing. The following paragraphs provide brief descriptions of these classifications of ceramics.

Sanitaryware is vitreous ceramic ware that is used for plumbing and bathroom fixtures and accessories, such as toilets and sinks. The primary raw materials used for manufacturing sanitaryware are ball clay, other clays, feldspar, and silica.

Tile is typically flat vitreous or semivitreous ceramic ware that is used to cover floors and walls. Tile is made primarily from ball clay, talc, nepheline syenite (an igneous rock comprised of nepheline, microline, and albite), fire clay, and shale. Products include glazed and unglazed floor and wall tile. This category includes all tile that is formed by pressing, whereas extruded clay tile are considered by EPA as part of the brick and structural clay products category.

Dinnerware is defined as vitreous or semivitreous ceramic ware, such as cups, plates, and bowls, that are used primarily for cookware and kitchenware. The raw materials most commonly used in dinnerware production include kaolin, ball clay, silica, and feldspar.

Pottery is a generic term for ceramics that contain clay and are not used for structural, technical, or refractory purposes. Pottery often is used for decorative purposes. Ball clay, kaolin, shale, feldspar, silica, and other clays are the primary raw materials typically used to produce pottery.

Emissions from clay ceramics facilities may include the following pollutants, generally in small amounts: lead, manganese, arsenic, beryllium, cadmium, chromium, mercury, nickel, benzene, formaldehyde, and dioxin. The metallic pollutants are emitted from HAP-containing glazes during the glazing operations, and also may be emitted during firing of ceramic products. The metals emissions during firing may emanate from the HAP in the glaze or from naturally occurring metals in the raw materials. Benzene and formaldehyde emissions may result from incomplete combustion of natural gas in ceramics kilns. Dioxins are listed because EPA has identified dioxins in ball clay deposits in the United States. EPA currently is examining the potential for dioxin emissions from thermal processing of ball clay.

7. Copper Foundries

NAICS: 331525, Foundries, Copper (except die casting)

SIC: 3366, Copper Foundries

SCC: 30400299, Industrial Processes, Secondary Metal Production, Copper, Other Not Classified

The Copper Foundries source category includes facilities that make copper and copper alloy (e.g. brass and bronze) castings, which are near final shape products that may be complex in form. A casting is made by pouring molten metal into a cavity that has the shape of the product.

The basic operations in all foundries are pattern and mold making, metal melting, pouring of the molten metal into some type of mold, cooling of the casting, and separation of the solid casting from the mold. Copper foundries commonly use sand, permanent mold, and investment casting. Other operations may include scrap preparation, finishing and cleaning of castings, mold preparation, and metallurgical treatment of the molten metal. The raw materials for this process are purchased copper alloy ingots.[1]

8. Electrical and Electronic Equipment Finishing Operations

NAICS: 333992, Welding and Soldering Equipment Manufacturing

333319, Other Commercial and Service Industry Manufacturing

333618, Other Engine Equipment Manufacturing

335129, Other Lighting Equipment Manufacturing

335312, Motor and Generator Manufacturing

335999, All Other Miscellaneous Electrical Equipment and Component Manufacturing

SIC: 3621, Motors and Generators

3699, Electrical Machinery, Equipment, and Supplies

SCC: 31399999, Industrial Processes, Electrical Equipment, Other Not Classified

40200101, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

40200110, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

[1]For a more detailed explanation of these procedures see the following memorandum from Driscoll, Barbara, EPA to Urban Strategy Docket, November 18, 2002. Expanded Description of Source Categories Listed in June 2002 for Future Regulatory Development, Section 5. Iron Foundries.

The Electrical and Electronic Equipment Finishing Operations category includes establishments primarily engaged in manufacturing motors and generators manufacturing and electrical machinery, equipment, and supplies, not elsewhere classified. Motors and generators manufacturing includes those establishments primarily engaged in manufacturing electric motors (except engine starting motors) and power generators; motor generator sets; railway motors and control equipment; and motors, generators and control equipment for gasoline, electric, and oil-electric buses and trucks. The electrical equipment component includes high energy particle acceleration systems and equipment, electronic simulators, appliance and extension cords, bells and chimes, and insect traps.

The main process used in the electrical equipment, NEC portion of the category is electroplating without chromium or cyanide. This process involves the production of metal coatings on a surface by electrodeposition. Commonly electroplated metals include nickel, copper, tin/lead, gold, and zinc. Electroplating is performed to provide corrosion protection, wear or erosion resistance, lubricity, electrical conductivity, or decoration.

In addition to water and metal, electroplating solutions often contain agents that form complexes with the metal being deposited, stabilizers to prevent hydrolysis, buffers for pH control, catalysts to assist in deposition, chemical aids for dissolving anodes, and miscellaneous ingredients that modify the process to attain specific properties.

Wastewater generated during electroplating without chromium or cyanide includes spent process solutions and rinses. Electroplating solutions occasionally become contaminated during use due to the dissolution of the base metal and the introduction of other pollutants. As this happens, the performance of the electroplating solutions diminishes. Spent concentrated solutions typically are treated for pollutant removal and reused, processed in a wastewater treatment system, or disposed of off site. Rinse waters, including some drag-out rinse tank solutions, are typically treated on site.[2]

Welding and shot peaning are the main operations in the motors and generators segment. Welding involves joining two or more pieces of material by applying heat, pressure, or both with or without filler material, to produce a metallurgical bond through fusion or recrystallization across the interface. Included in this definition are gas welding, resistance welding, arc welding, cold welding, electron beam welding, and laser beam welding. Welding typically is a dry process, except for the occasional use of contact cooling waters or rinses.

---

[2]For a more detailed explanation of these procedures see the following memorandum from Driscoll, Barbara, EPA to Urban Strategy Docket, November 18, 2002. Expanded Description of Source Categories Listed in June 2002 for Future Regulatory Development, Section 9. Plating and Polishing.

Shot-peaning or abrasive blasting involves removing surface films from a work piece by using abrasive directed at high velocity against the workpiece. Abrasive blasting includes bead, grit, shot, and sand blasting, and may be performed either dry or with water. The primary applications of wet abrasive blasting include removing burrs on precision parts; producing satin or matte finishes; removing fine tool marks; and removing light mill scale, surface oxide, or welding scale. Wet blasting can be used to finish fragile items such as electronic components. Some aluminum parts are wet blasted to achieve a fine-grained matte finish for decorative purposes. With abrasive blasting operations, the water and abrasive are typically reused until the particle size diminishes due to impacting and fracture.

9. Fabricated Plate Work (Boiler Shops)

NAICS: 332313, Saw Blade and Handsaw Manufacturing

332410, Powder Boiler and Heat Exchanger Manufacturing

332420, Metal Tank (Heavy Gauge) Manufacturing

333414**,** Heating Equipment (except Warm Air Furnaces) Manufacturing

SIC: 3443, Fabricated Plate Work (Boiler Shops); Fabricated Plate Work and Metal Weldments, Power Boilers and Heat Exchangers, Heavy Gauge Tanks, Metal Cooling Towers

SCC: 30901099, Industrial Processes, Fabricated Metal Products, Electroplating Operations

The Fabricated Plate Work (Boiler Shops) source category includes establishments primarily engaged in manufacturing power and marine boilers, pressure and nonpressure tanks, processing and storage vessels, heat exchangers, weldments and similar products. These products are formed by the process of cutting, forming and joining metal plates, shapes, bars, sheet, pipe mill products and tubing to custom or standard design. Three types of processes are involved in this source category; fabricating metal products, surface preparation, and metal finishing.

In fabricating metal products, molten metal is cast into a form that can enter various shaping processes. Manufacturers often use continuous casting techniques that allow the molten metal to be formed directly into sheets. The metal may be heat treated or fabricated cold. Heat treating is the modification of the physical properties of a workpiece through the application of controlled heating and cooling cycles. Cold metal is formed by applying direct physical pressure to the metal. The fabricating process usually employs the use of cutting oils, degreasing and cleaning solvents, acids, alkalis, and heavy metals.

Once molten metal is formed into a workable shape, shearing and forming operations are usually performed. Shearing operations cut materials into a desired shape and size, while forming operations bend or conform materials into specific shapes. Cutting or shearing operations include punching, piercing, blanking, cutoff, parting, shearing and trimming. Forming operations include bending, forming, extruding, drawing, rolling, spinning, coining, and forging the metal.

Surface preparation of fabricated metal products includes techniques ranging from abrasive blasting to acid washes, to multi-stage chemical cleaning processes. These methods are often used to prepare the surface of the product before it is finished.

Surface finishing usually involves a combination of metal deposition operations and numerous finishing operations. Several methods can be used in surface finishing, including anodizing, chemical conversion coating, electroplating, electroless plating on plastic products, painting, and other techniques. Anodizing is an electrolytic process which converts the metal surface to an insoluble oxide coating. Chemical conversion coating includes chromating, phosphating, metal coloring, and passivating operations.

Electroplating is the production of a surface coating of one metal upon another by electrodeposition. Electroplating activities involve applying predominantly inorganic coatings onto surfaces to provide corrosion resistance, hardness, wear resistance, anti-frictional characteristics, electrical or thermal conductivity, or decoration. In electroplating, metal ions in either acid, alkaline, or neutral solutions are reduced on the workpieces being plated. The metal ions in the solution are usually replenished by the dissolution of metal from solid metal anodes fabricated of the same metal being plated, or by direct replenishment of the solution with metal salts or oxides. Cyanide, usually in the form of sodium or potassium cyanide, is usually used as a complexing agent for cadmium and precious metals electroplating. Cyanide is used to a lesser degree for other solutions such as copper and zinc baths. The sequence of steps in electroplating includes: cleaning, stripping of old plating or paint, electroplating, and rinsing between and after each of these operations. Sealing and conversion coating may be performed after electroplating operations.

10. Fabricated Metal Products Manufacturing, Not Elsewhere Classified

NAICS: 332117, Powder Metallurgy Part Manufacturing

332439, Other Metal Container Manufacturing

332510, Hardware Manufacturing

332919, Other Metal Valve and Pipe Fitting Manufacturing

332999, All Other Miscellaneous Fabricated Metal Product Manufacturing

337215, Showcase, Partition, Shelving, and Locker Manufacturing

339914, Costume Jewelry and Novelty Manufacturing

33636, Motor Vehicle Seating and Interior Trim Manufacturing

SIC: 3499, Fabricated Metal Products, Not Elsewhere Classified; Metal Furniture Frames, Metal Motor Vehicle Seat Frames, Powder Metallurgy, Metal Boxes, Safe and Vault Locks, Metal Aerosol Valves, Other Metal Products

SCC: 3090, Industrial Processes, Fabricated Metal Products

This source category includes establishments primarily engaged in manufacturing fabricated metal products, not elsewhere classified, such as fire or burglary resistive steel safes and vaults and similar fire or burglary resistive products; and collapsible tubes of thin flexible metal. Also included are establishments primarily engaged in manufacturing metal boxes, metal ladders, and metal household articles, such as ice cream freezers and ironing boards.

A wide variety of processes can be used in the fabrication of metal products because of the wide variety of finished products. Three types of processes are generally involved in this source category; fabricating metal products, surface preparation, and metal finishing.

In fabricating metal products, molten metal is cast into a form that can enter various shaping processes. Manufacturers often use continuous casting techniques that allow the molten metal to be formed directly into sheets. The metal may be heat treated or fabricated cold. Heat treating is the modification of the physical properties of a workpiece through the application of controlled heating and cooling cycles. Cold metal is formed by applying direct physical pressure to the metal. The fabricating process usually employs the use of cutting oils, degreasing and cleaning solvents, acids, alkalis, and heavy metals.

Once molten metal is formed into a workable shape, shearing and forming operations are usually performed. Shearing operations cut materials into a desired shape and size, while forming operations bend or conform materials into specific shapes. Cutting or shearing operations include punching, piercing, blanking, cutoff, parting, shearing and trimming. Forming operations include bending, forming, extruding, drawing, rolling, spinning, coining, and forging the metal.

Surface preparation of fabricated metal products includes techniques ranging from abrasive blasting to acid washes, to multi-stage chemical cleaning processes. These methods are often used to prepare the surface of the product before it is finished.

Surface finishing usually involves a combination of metal deposition operations and numerous finishing operations. Several methods can be used in surface finishing, including anodizing, chemical conversion coating, electroplating, electroless plating on plastic products, painting, and other techniques. Anodizing is an electrolytic process which converts the metal surface to an insoluble oxide coating. Chemical conversion coating includes chromating, phosphating, metal coloring, and passivating operations.

Electroplating is the production of a surface coating of one metal upon another by electrodeposition. Electroplating activities involve applying predominantly inorganic coatings onto surfaces to provide corrosion resistance, hardness, wear resistance, anti-frictional characteristics, electrical or thermal conductivity, or decoration. In electroplating, metal ions in either acid, alkaline, or neutral solutions are reduced on the workpieces being plated. The metal ions in the solution are usually replenished by the dissolution of metal from solid metal anodes fabricated of the same metal being plated, or by direct replenishment of the solution with metal salts or oxides. Cyanide, usually in the form of sodium or potassium cyanide, is usually used as a complexing agent for cadmium and precious metals electroplating. Cyanide is used to a lesser degree, for other solutions such as copper and zinc baths. The sequence of steps in electroplating includes: cleaning, stripping of old plating or paint, electroplating, and rinsing between and after each of these operations. Sealing and conversion coating may be performed after electroplating operations.[2]

11. Fabricated Structural Metal Manufacturing

NAICS: 332312, Fabricated Structural Metal Manufacturing

SIC: 3441, Fabricated Structural Metal

SCC: 3090, Industrial Processes, Fabricated Metal Products

The Fabricated Structural Metal Manufacturing source category includes establishments primarily engaged in fabricating iron and steel or other metal for structural purposes, such as bridges, buildings, and sections for ships, boats, and barges.

Processes used in this source category vary, but some common processes include heating and welding of the raw iron, steel, or stainless steel; shot blasting or sand blasting; grinding; polishing; and pickling, or dipping the product in acid. Three general types of processes are involved in this source category; fabricating metal products, surface preparation, and metal finishing.

---

[2]For a more detailed explanation of these procedures see the following memorandum from Driscoll, Barbara, EPA to Urban Strategy Docket, November 18, 2002. Expanded Description of Source Categories Listed in June 2002 for Future Regulatory Development, Section 9. Plating and Polishing.

In fabricating metal products, molten metal is cast into a form that can enter various shaping processes. Manufacturers often use continuous casting techniques that allow the molten metal to be formed directly into sheets. The metal may be heat treated or fabricated cold. Heat treating is the modification of the physical properties of a workpiece through the application of controlled heating and cooling cycles. Cold metal is formed by applying direct physical pressure to the metal. The fabricating process usually employs the use of cutting oils, degreasing and cleaning solvents, acids, alkalis, and heavy metals.

Once molten metal is formed into a workable shape, shearing and forming operations are usually performed. Shearing operations cut materials into a desired shape and size, while forming operations bend or conform materials into specific shapes. Cutting or shearing operations include punching, piercing, blanking, cutoff, parting, shearing and trimming. Forming operations include bending, forming, extruding, drawing, rolling, spinning, coining, and forging the metal.

Surface preparation of fabricated metal products includes techniques ranging from abrasive blasting to acid washes, to multi-stage chemical cleaning processes. These methods are often used to prepare the surface of the product before it is finished.

Surface finishing usually involves a combination of metal deposition operations and numerous finishing operations. Several methods can be used in surface finishing, including anodizing, chemical conversion coating, electroplating, electroless plating on plastic products, painting, and other techniques. Anodizing is an electrolytic process which converts the metal surface to an insoluble oxide coating. Chemical conversion coating includes chromating, phosphating, metal coloring, and passivating operations.

Electroplating is the production of a surface coating of one metal upon another by electrodeposition. Electroplating activities involve applying predominantly inorganic coatings onto surfaces to provide corrosion resistance, hardness, wear resistance, anti-frictional characteristics, electrical or thermal conductivity, or decoration. In electroplating, metal ions in either acid, alkaline, or neutral solutions are reduced on the workpieces being plated. The metal ions in the solution are usually replenished by the dissolution of metal from solid metal anodes fabricated of the same metal being plated, or by direct replenishment of the solution with metal salts or oxides. Cyanide, usually in the form of sodium or potassium cyanide, is usually used as a complexing agent for cadmium and precious metals electroplating, and to a lesser degree, for other solutions such as copper and zinc baths. The sequence of steps in electroplating includes: cleaning; stripping of old plating or paint; electroplating; and rinsing between and after each of these operations. Sealing and conversion coating may be employed on the metals after electroplating operations.[2]

---

[2]For a more detailed explanation of these procedures see the following memorandum from Driscoll, Barbara, EPA to Urban Strategy Docket, November 18, 2002. Expanded Description of

12. Ferroalloys Production: Ferromanganese and Silicomanganese

NAICS: 331112, Electrometallurgical Products, Except Steel

SIC: 3313, Electrometallurgical Ferroalloy Product Manufacturing

SCC: 30300608, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Raw Material Unloading

30300609, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Raw Material Crushing

30300617, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Cast House

30300618, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Mix House/Weighing

30300619, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Raw Material Charging

30300620, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Tapping

30300621, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Casting

30300622, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Cooling

30300623, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Product Crushing

30300624, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace, Product Storage

30300625, Industrial Processes, Primary Metal Production, Ferroalloy, Open Furnace,

---

Product Loading

This source category includes facilities primarily engaged in manufacturing ferroalloys. A ferroalloy is an alloy of iron and one or more other elements other than carbon. Ferroalloys are used primarily by steel and cast iron manufacturers to add special properties to their final products. Ferroalloys are the alloying metals added to steel to confer properties such as hardness, tensile strength, and corrosion resistance.

Manganese and silicon are used in small quantities in the production of carbon steels; other metals are used chiefly in the production of alloy or stainless steels. Alloying metals are usually charged into the steelmaking furnace in the form of ferroalloys. Ferromanganese, ferrosilicon, and ferrochrome are the three largest ferroalloys consumed in the United States.

Ferroalloys are made from ores in which the metallic component has a relatively high affinity for oxygen and other non-metals. Therefore, substantial quantities of electrical energy are required to extract the metals from their ores. This process occurs in a variety of types of furnaces. Most ferroalloys within the scope of this source category are produced using submerged electric arc furnaces (EAF), which are furnaces in which the electrodes are submerged into the charge. Submerged EAF are predominantly characterized by their energy rating and design-type. Furnace design capacities range from 9 megawatts (MW) to 50 MW, and average just over 20 MW. Submerged EAF are classified as open, semi-sealed, or sealed, depending on their configuration.

The main difference between the open, semi-sealed, and sealed submerged EAF is the presence and design of a furnace cover. The furnace cover influences the extent to which reaction gases are combusted at the furnace surface.

In an open furnace, the reaction gases burn with induced air at the top of the charge, converting carbon monoxide (CO) to carbon dioxide (CO_2). The combusted gases are collected by a hood over the furnace and are directed by duct work to control devices and/or to the atmosphere. Domestic producers often prefer the use of open furnaces for the production of some products, such as those containing a high percentage of silicon.

Semi-sealed furnaces have water-cooled covers over the top of the furnace. The covers have holes in them to allow the electrodes to extend into the charge. Generally, feed materials are charged to the furnace through the annular openings in the cover around the electrodes. Some semi-sealed furnaces have charge chutes that extend through the cover and into the furnace. Because the cover is largely sealed, combustion does not occur under the cover, and the CO content of the gases under the cover is high. Because the cover minimizes access to the furnace surface for stoking, products produced in semi-sealed furnaces generally require little or no stoking of the charge material.

A sealed furnace differs from a semi-sealed furnace in that the cover, annular openings around the electrodes, and openings around the charge chute are mechanically sealed so that no exhaust gases escape form the furnace surface.

Ferroalloys production consists of charging the furnace with raw materials, smelting the ores, and tapping or removing the molten product. In the charging process, raw materials are gravity fed to the furnace through charge chutes. Charging can be periodic or continuous and can be computer automated or manual. Raw materials typically include carbon-containing material such as coal, coke, quartz, and wood chips, along with a metallic ore. Carbon-containing raw materials are used to oxidize metallic or raw materials, yielding elemental metal and large quantities of CO.

The raw materials must be periodically moved around or "stoked" to prevent excessive "blowing." Blows are jets of extremely hot gas that issue from the high-temperature reaction zone and flow upward around the electrodes at high velocity. Stoking is usually performed by the furnace operator and can either be performed by manually moving a long pole back and forth to stoke the charge or by mounting the pole on a vehicle called a "ram-stoker" that drives the pole back and forth at the furnace surface.

During smelting, power is applied continuously to the electrodes, and feed materials may be charged to the furnace on either a continuous or intermittent basis. The major smelting occurs in the area immediately surrounding the electrodes, termed the "reaction zone."

The two types of electrodes used in the industry are the Soderberg, or self-baking electrode and prebaked electrode. The Soderberg electrode is purchased in blocks or cylinders of a self-baking paste. The carbon paste blocks are added as needed to an electrode column above the furnace. As a block moves down the column, it melts and bakes in place to form a homogeneous electrode before reaching the reaction zone. The prebaked electrode is baked prior to being used in the furnace. Depending on the type of electrode, more prebaked electrodes or more self-baking electrode paste must periodically be added during smelting.

The carbon electrodes are suspended vertically over the hearth and extend 3 to 5 feet into the charge materials. The carbon electrodes convert electrical energy to heat energy within the furnace charge. Typically three electrodes are used, arranged in a delta formation, although some furnaces employ single electrodes or electrodes arranged in a packet. The packet is a rectangular formation of 6 to 8 electrodes.

Although the electrodes are fixed horizontally, some vertical movement occurs in each electrode to keep the depth of the electrode at the optimal place for ferroalloys production and to maintain a near uniform electrical load. Vertical movement is controlled by mechanical or hydraulic means.

Tapping is the process whereby the molten product is removed from the furnace. For most furnaces, tapping is done through one or more tap holes, which are openings created in the furnace specifically for product removal. In one case, the EAF is mechanically lifted, and the molten product is poured from the furnace. The tapping process can be continuous or periodic. Tap holes are opened with pellet shots from a gun, by drilling, or by oxygen lancing. The molten metal runs from the tap hole into a carbon-lined trough, and then into a carbon-lined runner that directs the metal and slag into a reaction ladle, molds, pots, or chills. Chills are low, flat, iron or steel pans that provide rapid cooling of the molten metal. After the tap is completed, the furnace is resealed by inserting a plug, usually made of carbon paste, into the tap hole. When tapping is continuous, a single tap hole may be kept open at all times, or multiple tap holes may be kept alternately open.

13. Heating Equipment Manufacturing, Except Electric

NAICS: 333414, Heating Equipment (Except Warm Air Furnaces) Manufacturing

SIC: 3433, Heating Equipment, Except Electric and Warm Air Furnaces

SCC: 39999999, Industrial Processes, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

This source category includes establishments primarily engaged in manufacturing heating equipment, except electric and warm air furnaces, including gas, oil, and stoker coal fired equipment for the automatic utilization of gaseous, liquid, and solid fuels. Typical products produced in this source category include low-pressure heating (steam or hot water) boilers, fireplace inserts, domestic (steam or hot water) furnaces, domestic gas burners, gas room heaters, gas infrared heating units, combination gas-oil burners, oil or gas swimming pool heaters, heating apparatus (except electric or warm air), kerosene space heaters, gas fireplace logs, domestic and industrial oil burners, radiators (except electric), galvanized iron nonferrous metal range boilers, room heaters (except electric), coke and gas burning salamanders, liquid or gas solar energy collectors, solar heaters, space heaters (except electric), mechanical (domestic and industrial) stokers, wood and coal-burning stoves, domestic unit heaters (except electric), and wall heaters (except electric).

Processes involved in this source category include grinding, machining, and welding. Grinding involves removing stock from a workpiece by using abrasive grains held by a rigid or semirigid binder. Grinding shapes or deburrs the workpiece. The grinding tool is usually a disk, but can also be a cylinder, ring, cup, stick, strip, or belt. The most commonly used abrasives are aluminum oxide, silicon carbide, and diamond. The process may use a grinding fluid to cool the part and remove debris or metal fines. Wastewater generated during grinding includes spent coolants and rinses. Metal-working fluids are spent for a number of reasons, including increased biological activity or decomposition of the coolant additives. Rinse waters are typically assimilated into the working fluid or treated on site.

Machining involves removing stock from a workpiece as chips by forcing a cutting tool against the workpiece. This includes machining processes such as turning, milling, drilling, boring, tapping, planing, broaching, sawing, cutoff, shaving, shearing, threading, reaming, shaping, slotting, hobbing, and chamfering. Machining processes use various types of metal working fluids, the choice of which depends on the type of machining being performed and the preference of the machine shop. The fluids can be categorized into four groups: straight oil (neat oils), synthetic, semisynthetic, and water-soluble oil. Machining operations generate wastewater from working fluid or rinse water discharge. Metal working fluids periodically are discarded because of reduced performance or development of a rancid odor. After machining, parts are sometimes rinsed to remove coolant and metal chips. The coolant reservoir can be rinsed, and the rinse water is added to the working fluid.

Welding involves joining two or more pieces of material by applying heat, pressure, or both, with or without filler material, to produce a metallurgical bond through fusion or recrystallization across the interface. Included in this definition are gas welding, resistance welding, arc welding, cold welding, electron beam welding, and laser beam welding. Welding typically is a dry process, except for the occasional use of contact cooling waters or rinses.

14. Industrial Machinery and Equipment: Finishing Operations

NAICS: 333911, Pump and Pumping Equipment Manufacturing

33312, Construction Machinery Manufacturing

333132, Oil and Gas Field Machinery and Equipment Manufacturing

SIC: 3533, Oil and Gas Field Equipment and Machinery

3561, Pumps and Pumping Equipment

3531, Construction Machinery and Equipment (except railway track maintenance equipment, winches, aerial work platforms, and auto)

SCC: 30405099, Industrial Processes, Secondary Metal Production, Miscellaneous Casting Fabricating

30900198, Industrial Processes, Fabricated Metal Products, General Processes, Other Not Classified

30904001, Industrial Processes, Fabricated Metal Products, Metal Deposition Processes, Metalizing Wire Atomization and Spraying

30904010, Industrial Processes, Fabricated Metal Products, Metal Deposition Processes, Thermal Spraying of Powdered Metal

30900500, Industrial Processes, Fabricated Metal Products, Welding, General

30905104, Industrial Processes, Fabricated Metal Products, Shielded Metal Arc Welding, 14mn-4cr Electrode

30905306, Industrial Processes, Fabricated Metal Products, Flux Cored Arc Welding, E110 T5-K3 Electrode

30999999, Industrial Processes, Fabricated Metal Products, Other Not Classified

31299999, Industrial Processes, Machinery/Miscellaneous, Miscellaneous Machinery, Other Not Classified

31303061, Industrial Processes, Electrical Equipment, Manufacturing– General, Circuit Board Etching: Acid

39999994, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes, Other Not Classified

39999999, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

40200101, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

40200110, Industrial Processes, Miscellaneous Metal Manufacturing, Miscellaneous Manufacturing Industries, Miscellaneous Industrial Processes

The Industrial Machinery and Equipment: Finishing Operations source category includes finishing operations for construction machinery manufacturing, oil and gas field machinery manufacturing, and pumps and pumping equipment manufacturing. Finishing operations include the collection of all operations associated with the surface coating of industrial machinery and equipment. These operations include preparation of a coating for application (e.g., mixing with thinners); surface preparation of the machinery or equipment; coating application and flash-off; drying and/or curing of applied coatings; cleaning of equipment used in surface coating; storage of coatings, thinners, and cleaning materials; and handling and conveyance of waste materials from the surface coating operations.

Construction machinery manufacturing includes establishments primarily engaged in manufacturing heavy machinery and equipment of types used primarily by the construction industries, such as bulldozers; concrete mixers; cranes, except industrial plant overhead and truck-type cranes; dredging machinery; pavers; and power shovels. Also included in this industry are establishments primarily engaged in manufacturing forestry equipment and certain specialized equipment, not elsewhere classified, similar to that used by the construction industries, such as elevating platforms, ship cranes and capstans, aerial work platforms, and automobile wrecker hoists.

Oil and gas field machinery include establishments primarily engaged in manufacturing machinery and equipment for use in oil and gas fields or for drilling water wells, including portable drilling rigs.

The pumps and pumping equipment category includes establishments primarily engaged in manufacturing pumps and pumping equipment for general industrial, commercial, or household use, except fluid power pumps and motors. This category includes establishments primarily engaged in manufacturing domestic water and sump pumps.

Several processes are used in the finishing operations of industrial equipment and machinery. These processes include chemical conversion coating without chromium, chromate conversion coating (chromating), grinding, machining, welding, electroplating with chromium, electroless plating, metal spraying or flame spraying, and shot peaning.

Chemical conversion coating without chromium is the process of applying a protective coating on the surface of a metal without using chromium. Such coatings are applied through phosphate conversion, metal coloring, or passivation. Coatings are applied to a base metal or previously deposited metal to increase corrosion protection and lubricity, prepare the surface for additional coatings, or formulate a special surface appearance. This process includes sealant processes that use additives other than chromium. In phosphate conversion, coatings are applied for one or more of the following reasons: to provide a base for paints and other organic coatings, to condition surfaces for cold forming operations by providing a base for drawing compounds and lubricants; to impart corrosion resistance to the metal surface; or to provide a suitable base for corrosion-resistant oils or waxes. Phosphate conversion coatings are formed by immersing a metal part in a dilute solution of phosphoric acid, phosphate salts, and other reagents.

Grinding involves removing stock from a workpiece by using abrasive grains held by a rigid or semirigid binder. Grinding shapes or deburrs the workpiece. The grinding tool is usually shaped like a disk, but can also be a cylinder, ring, cup, stick, strip, or belt. The most commonly used abrasives are aluminum oxide, silicon carbide, and diamond. The process may use a grinding fluid to cool the part and remove debris or metal fines. Wastewater generated during grinding includes spent coolants and rinses. Metal-working fluids become waste for a number of reasons, including increased biological activity or decomposition of the coolant additives. Rinse waters are typically assimilated into the working fluid or are treated on site.

Machining involves removing stock from a workpiece as chips by forcing a cutting tool against the workpiece. This includes machining processes such as turning, milling, drilling, boring, tapping, planing, broaching, sawing, cutoff, shaving, shearing, threading, reaming, shaping, slotting, hobbing, and chamfering. Machining processes use various types of metal working fluids, the choice of which depends on the type of machining being performed and the preference of the machine shop. The fluids can be categorized into four groups: straight oil, synthetic, semisynthetic, and water-soluble oil. Machining operations generate wastewater from working fluid or rinse water discharge. Metal working fluids periodically are discarded because of reduced performance or development of a rancid odor. After machining, parts are sometimes rinsed to remove coolant and metal chips. The coolant reservoir is sometimes rinsed, and the rinse water is added to the working fluid.

Welding involves joining two or more pieces of material by applying heat, pressure, or both with or without filler material, to produce a metallurgical bond through fusion or recrystallization across the interface. Included in this definition are gas welding, resistance welding, arc welding, cold welding, electron beam welding, and laser beam welding. Welding typically is a dry process, except for the occasional use of contact cooling waters or rinses.

Electroless plating involves deposition of a metallic coating by a controlled chemical reduction that is catalyzed by the substitute material being deposited without using an electrical current. The metal to be plated onto a part is typically held in solution at high concentrations by the use of a chelating agent. This plates all areas of the part to a uniform thickness regardless of the configuration of the part. Also, an electroless-plated surface is dense and virtually nonporous. Copper and nickel electroless plating operations are the most common. Sealant operations (i.e., other than hot water dips) following electroless plating are considered separate unit operations if they include any additives. Wastewater generated during electroless plating includes spent process solutions and rinses. The wastewater contains chelated metals, which require separate preliminary treatment to break the metal chelates prior to conventional chemical preparation. Rinsing follows most electroless plating processes to remove residual plating solution and prevent contamination of subsequent process baths.

Metal spraying or flame spraying involves applying a metallic coating to a workpiece by projecting molten or semimolten metal particles onto a substrate. Coatings can be sprayed from rod or wire stock or from powdered material. This process involves feeding the material into a flame where it is melted. The molten stock is then stripped from the end of the wire and atomized by a high-velocity stream of compressed air or other gas that propels the material onto a prepared substrate or part. Metal spraying coatings are used in a wide range of special applications, including in insulating layers in applications such as induction heating coils, electromagnetic interference shielding, thermal barriers for rocket engines, nuclear moderators, films for hot isostatic pressing, and dimensional restoration of worn parts. Metal spraying is sometimes performed in front of a water curtain, a circulated water stream used to trap overspray, or a dry filter exhaust hood that captures the overspray and fumes. With water curtain systems, water is recirculated from a sump or tank. Wastewater is generated when the sump or tank is discharged periodically. Metal spraying is typically not followed by rinsing.

Shot-peaning or abrasive blasting involves removing surface films from a work piece by using abrasive directed at high velocity against the workpiece. Abrasive blasting includes bead, grit, shot, and sand blasting, and may be performed either dry or with water. The primary applications of wet abrasive blasting include removing burrs on precision parts; producing satin or matte finishes; removing fine tool marks; and removing light mill scale, surface oxide, or welding scale. Wet blasting can be used to finish fragile items such as electronic components. Some aluminum parts are wet blasted to achieve a fine-grained matte finish for decorative purposes. With abrasive blasting operations, the water and abrasive are typically reused until the particle size diminishes due to impacting and fracture.

15. Inorganic Pigments Manufacturing

NAICS: 32513, Synthetic Dyes and Pigment Manufacturing

325131, Inorganic Dye and Pigment Manufacturing

SIC: 2816, Inorganic Pigments Except Bone and Lamp Black

SCC: 301035, Industrial Processes, Chemical Manufacturing, Inorganic Pigments

The majority of inorganic pigments are oxides, sulfides, oxide hydroxides, silicates, sulfates, or carbonates. Inorganic pigments normally consist of single component particles.

Generally, production processes for inorganic pigments can be divided into two groups; those that use partial combustion and those using pure pyrolysis. The best available information for inorganic pigment production was found for black pigments. The production process for black inorganic pigments using the lamp black process is described in this section. In partial combustion, air is used to burn part of the feedstock, thus producing the energy necessary for pyrolysis. In the pure pyrolysis method, heat is generated externally and is introduced into the process. Furnace black, gas black, channel black, lamp black, thermal black, acetylene black, and other processes are used to produce inorganic pigments.

The lamp black process is partially continuous. Oils with a high aromatic hydrocarbon content are used as feedstock. The feedstock is burned in flat vessels and oil is continuously introduced into the vessel to keep a constant feedstock level. Off-gas containing carbon black is sucked off into a conical exhaust pipe leading to the collection system. The variation of the distance between the vessel and the exhaust and the amount of air sucked into the apparatus can vary the properties of the carbon black.

16. Iron and Steel Forging

NAICS: 332111, Iron and Steel Forgings

SIC: 3462, Iron and Steel Forgings

SCC: 303015, Industrial Process, Primary Metal Production, Integrated Iron and Steel Manufacturing

Forging is a manufacturing process where purchased iron and steel metal is pressed, pounded or squeezed under great pressure into high strength parts known as forgings. The process is normally (but not always) performed hot by preheating the metal to a desired temperature before it is worked. It is important to note that the forging process is different from the casting and foundry processes, as metal used to make forged parts is never melted and poured. Iron and steel forging plants may perform surface finishing operations, such as cleaning and deburring on the forgings they manufacture.

Generally, forged components are shaped either by a hammer or a press. Forging on the hammer is carried out in a succession of die impressions using repeated blows. In a press, the stock is usually hit only once in each die impression. Most forging is done as hot work by heating the metal stock in furnaces (metal is heated to temperatures up to 2,300°F). These furnaces are typically fired using natural gas or fuel oil, but at some facilities coal is burned in the furnaces. In addition, some parts are made using cold forging, with little or no preheating of the metal.

Four types of forging processes are used to make a forged part. The type of process used depends on factors including the product size, metal composition, and product end use or application.

Impression die forging pounds or presses the metal between two dies (called tooling) that contain a precut profile of the desired part. Parts with a mass of a few ounces and up to 60,000 pounds can be made using this process.

Open die forging is performed between flat dies with no precut profiles in the dies. Larger parts over 200,000 pounds and 80 feet in length can be hammered or pressed into a shape this way.

Seamless rolled ring forging is typically performed by punching a hole in a thick, round piece of metal (creating a donut shape), and then rolling and squeezing (or in some cases, pounding) the donut into a thin ring. Ring diameters can be anywhere from a few inches to 30 feet.

Cold forging is a type of impression die forging using lubricant and circular dies at or near room temperature. Carbon and standard alloy steels are most commonly cold-forged. Parts are generally symmetrical and rarely exceed 25 pounds. The primary advantage of cold forging is the material savings achieved through precision shapes that require little finishing.

After deformation of the metal part using one of the above methods, the forged part may undergo further metalworking at the facility. This work can include removing flash, punching holes, improving the metal surface finish, and additional machining to achieve closer dimensional accuracy.

17. Nonferrous Foundries, Not Elsewhere Classified

NAICS: 331528, Foundries (except die-casting), Nonferrous Metals (except aluminum, copper)

SIC: 3369, Nonferrous Foundries, Except Aluminum and Copper

SCC: 2304050000, Industrial Processes, Secondary Metal Production, Nonferrous Foundries

The Nonferrous Foundries, Not Elsewhere Classified source category includes facilities that make nonferrous alloy metal (e.g. other than aluminum and copper) castings, which are near final shape products that may be complex in form. A casting is made by pouring molten metal into a cavity that has the shape of the product.

The basic operations in all foundries are pattern and mold making, metal mining, pouring of the molten metal into some type of mold, cooling of the casting, and separation of the solid casting from the mold. Other operations may include scrap preparation, finishing and cleaning of castings, mold preparation, and metallurgical treatment of the molten metal. The raw materials are purchased pre-alloyed nonferrous metals ingots other than copper alloy and aluminum.[1]

18. Paints and Allied Products Manufacturing

NAICS: 325510, Paint and Coating Manufacturing

SIC: 2851, Paints, Varnishes, Enamels, Lacquers, and Allied Products

SCC: 301014, Industrial Processes, Chemical Manufacturing, Paint Manufacture

301015, Industrial Processes, Chemical Manufacturing, Varnish Manufacturing

The Paints and Allied Products Manufacturing industry comprises establishments primarily engaged in (1) mixing pigments, solvents, and binders into paints and other coatings, such as stains, varnishes, lacquers, enamels, shellacs, and water repellant coatings for concrete and masonry, and/or (2) manufacturing allied paint products, such as putties, paint and varnish removers, paint brush cleaners, and frit.

---

[1]For a more detailed explanation of these procedures see the following memorandum from Driscoll, Barbara, EPA to Urban Strategy Docket, November 18, 2002. Expanded Description of Source Categories Listed in June 2002 for Future Regulatory Development, Section 5. Iron Foundries.

Paints are suspensions of finely separated pigment particles in a liquid that when spread over a surface in a thin layer will form a solid, cohesive, and adherent film. Types of paints that are currently manufactured include architectural coatings, product finishes (e.g., for automobiles, machinery, metal and wood furniture, and appliances), and special-purpose coatings (e.g., industrial new construction and maintenance paints, traffic marking paints, and marine paints).

Paint manufacturing can be classified as a batch process and generally involves the blending and mixing of resins, pigments, solvents, and additives. Traditional paint manufacturing consists of four major steps: (1) Preassembly and premix; (2) Pigment grinding, milling, and dispersing; (3) Product finishing and blending; and (4) Product filling and packaging.

Operations that involve the handling of pigments and other solids result in the majority of metallic HAP emissions. Material loading and the pigment grinding and milling operations are the major source of particulate (e.g., metallic HAP) emissions. Pigment grinding or milling entails the incorporation of the pigment into the paint and ink vehicle to yield a fine particle dispersion. The three stages of this process include wetting, grinding, and dispersion, which may overlap in any grinding operation. The wetting agent, normally a surfactant, wets the pigment particles by displacing air, moisture, and gases that are adsorbed on the surface of the pigment particles. Grinding is the mechanical breakup and separation of pigment clusters into isolated particles and may be facilitated by the use of grinding media such as pebbles, balls, or beads. Finally, dispersion is the movement of wetted particles into the body of the liquid vehicle to produce a particle suspension.

There is a wide array of milling equipment. The type of equipment used depends on the types of pigments being handled. More commonly used equipment include the following: roller mills, ball and pebble mills, attritors, sand mills, bead and shot mills, high-speed stone and colloid mills, high-speed dispersers, high-speed impingement mills, and horizontal media mills. Roller and ball mills are considered somewhat outdated methods and are usually associated with elevated volatile organic compound (VOC) emissions due to their more open design.

High-speed dispersers are the most universally used method of dispersion in the industry. Some paint and ink blends are manufactured entirely in one piece of equipment using high-speed, disk-type impellers. Because no grinding media are present in the mixing vat, pigment disperses on itself and against the surfaces of the rotor. While high-speed disk dispersion may work well for some products such as undercoats and primers, it may not be appropriate for high-quality paints and inks. It can, however, be used for premix operations of high-quality paints and inks, thus reducing the number of passes in a media mill or reducing the amount of time spent in a ball mill.

19. Plastic Parts and Products (Surface Coating)

NAICS: 32613, Laminated Plastics Plate, Sheet, and Shape Manufacturing

326199, All Other Plastics Product Manufacturing

SIC: 3083, Laminated Plastics Plate, Sheet, and Profile Shapes

3089, Plastic Products, NEC

SCC: 3080100, Industrial Processes, Rubber and Miscellaneous Plastics Products, Plastic Products Manufacturing

Surface coating of plastic parts and products occurs in a wide variety of manufacturing processes. Plastic parts and products that receive surface coating are those that require protection from the environment in which they are used or for which consumers expect a certain finished appearance. The major plastics manufacturing industry sectors that apply surface coatings include: heavy duty truck parts, automobile and light duty truck parts, and miscellaneous parts.

Plastic parts surface coating facilities may fall into one of the following categories:
(1) An in-house process that is located at the end-product manufacturing site (common in automotive and truck manufacturing industries);
(2) A contractor facility that specializes in plastic parts molding and coating;
(3) A contract coating facility that performs only painting.

There is not a typical coating line for all plastic parts and products surface coating operations. The following descriptions are generally typical of coating lines.

Surface preparation is performed to correct flaws in the part prior to coating and to prepare the part to receive the coating. Some sanding may be performed to remove burrs or other surface inconsistencies. Puttying may be necessary to fill in any gaps or small cracks in the plastic part. For pre-primed plastic parts, spot primer may be applied to any areas missing primer or with an inconsistent primer application. Following this type of pretreatment, any remaining surface residue must be removed, typically by wiping off the dust with water or solvent soaked rags. Acetone or a hot water and grit material solution can also be used as an alternative to HAP or VOC-laden solvents to remove any tape adhesion, dirt, or dust.

Coatings are typically applied in partially or totally enclosed spray booths. Automated spray booth systems are more likely to be used in larger facilities or for parts with flat or uniform surfaces. Parts may be manually wheeled to the spray booths on drying racks and placed into and out of the booth by hand, or the parts may be automatically conveyed to the booths via racks or paint hooks. Regardless of how the parts are introduced into the spray booth, the booths have some common characteristics. A positive or negative pressure exhaust system is used to ensure airflow through a filtering mechanism. Some typical configurations for the filtering systems include down draft airflow through a water curtain that runs below a grilled floor, and cross draft airflow through dry filters on the rear wall of the booth. The exhaust system dilutes the airborne solvent to safe concentrations inside the booth. The filtering mechanisms control overspray, but do not collect solvent vapors. Overspray is the coating solids that either miss or bounce off the part. Partially open booths are subject to the ambient environmental conditions at the facility, but fully enclosed booths are typically monitored to ensure a desired exhaust airflow, temperature, and humidity (all of which contribute to the quality of the finished part's coating). A coating line can consist of a combination of booth types, and a single part may be coated multiple times in the same booth to apply different coatings with different properties (such as color).

Tape, paper, or other types of shields can be used to mask certain portions of the plastic part so that the color is applied only to the proper area. The part is coated in one color, masked, and then coated in a different color. When the masking is removed, the part will have the multiple colors in the designated areas. When a coating is changed in a paint booth, the spray equipment must be cleaned prior to introduction of the new coating. This is usually accomplished by running an amount of cleaning solvent through the spray equipment in the booth. The degree of cleaning necessary and the types of solvents used are both functions of the previous coating and the next coating.

Immediately following coating application, plastic parts are introduced into a flash-off zone. This zone can be a designated area on an automated coating line between the spray booth and curing oven, or the zone can simply be the drying rack in a manual line where the parts are placed prior to entering a curing oven. The purpose of the flash off area is to allow partial curing as solvent evaporates from the coated part.

Conventional coatings for plastics are generally classified as high-bake or low-bake. High-bake coatings require elevated temperatures to fully cure. Typical temperature and residence time for high-bake coatings is 20 minutes at up to 300° F, whereas typical temperature and residence time for low-bake coatings is 20 to 30 minutes at up to 130° F. Many plastic part coatings will cure satisfactorily at ambient conditions, but plastic parts are often introduced to elevated temperature to speed the curing time. The desired curing conditions, including temperature, residence time, and humidity, are highly dependent on the type of coating used and the properties of the substrate being coated. For example, a coating that requires a bake temperature of 300° F cannot be used on plastic that deforms or distorts at that temperature. Therefore, substrates such as acrylonitrile butadiene styrene resins and epoxies that are not heat tolerant require coatings that cure at low temperatures. Such coatings tend to have higher VOC or HAP content to promote adequate curing speed.

Electroless plating is the process of applying a film of metallic coating to plastic surfaces, involving immersion of the part in solution after pretreatment. Metallic coatings are formed as a result of a chemical reaction between the reducing agent present in the solution and metal ions. No electric currents are used, as opposed to electroplating which does use current.

Electroplating is the process of depositing a layer of metal onto plastic surfaces using an electric current. The plastic surface must be made conductive in order to be electrolytically plated. This is accomplished by applying a thin layer of electroless plating or by the use of substrate additives such as carbon filler.

Some facilities manufacture and assemble the plastic parts that they coat, and this often involves glueing two pieces of plastic together. While some advanced adhesive-free technologies, such as ultrasound welding, are applicable to certain limited applications, most adhesion is accomplished through application of a solvent or combination of solvents. Typical adhesives include tetrahydrofuran, methylene chloride, and methylphthalate-based two-part epoxies.

The solvent breaks down the plastic molecules on the surfaces to be joined, and the fused part, following adhesion, has strong bond characteristics. Because of the interaction between the solvent adhesive and the plastic substrates, not all adhesives will perform with all substrates. Substrate properties and desired bond strength dictate which adhesives can be used.

Solvents used for adhesion are often stored in air-tight canisters and are applied to the plastic through syringes or other methods that minimize the possibility of VOC or HAP emissions by minimizing the amount of solvent used and the exposure time of the solvent to the air. Some volatilization will occur as the adhesive cures.

When a change in coating is made, the spray equipment– and perhaps the booth itself, must be cleaned. Cleaning solvents are typically used to spray through the application equipment or wipe down the interior of the spray booth.

Cleaning solvents may be used in the touch-up areas to either prepare a part for a touch-up coating or to clean a part prior to final product delivery. For example, solvent can be wiped by hand across the plastic part to make it appear clean and shiny prior to shipment. Spent cleaning solvents are collected along with coating waste. These materials are typically treated or disposed off-site although some facilities collect spent solvents and recycle and reuse them on-site. Solvents also may be used to hand clean the molds.

Spray technologies are an alternative method of applying coating. In the traditional spray method of applying coatings, conventional air spray, compressed air is supplied through an air hose to a spray gun, which atomizes the coating into a fine spray. One of the major problems with conventional air spray is the overspray caused by the high volume of air required to achieve atomization. This overspray typically results in a relatively poor transfer efficiency.

Airless spray uses a pump to force the coating through an atomizing nozzle at high pressure (1,000 to 6,000 psi). Airless spray is ideal for rapid coverage of large areas and when a heavy film build is required. The size of airless spray paint droplets is larger, the spray cloud is less turbulent, and the transfer efficiency is typically superior to conventional air spray. Airless spray leaves a rougher, more textured surface and is generally used on surfaces where appearance is not critical.

Air-assisted airless spray combines conventional air spray and airless spray. The system consists of an airless spray gun with a compressed air jet at the gun tip to atomize the coating and control the fan shape of coating.

High-volume/low-pressure (HVLP) spray uses large volumes of air under reduced pressure (10 or less psi) to atomize coatings. Because of the lower air pressure, the atomized spray is released from the gun at a lower velocity. Overspray is reportedly reduced 25 to 50 percent over conventional air spray.

In electrostatic spray the coating and part are oppositely charged; the part is grounded and attracts the negatively charged coating droplets. Electrostatic spray systems are reported to have the highest transfer efficiency of any of the spray application techniques because of minimal overspray which also results in lower paint loss and lower VOC emissions. One limitation of the electrostatic spray technique is that the part to be coated must be conductive. Plastic parts not made of a conductive substrate are often made conductive by applying compatible polar solutions to the surfaces and/or placing the parts on a metal backing.

In zinc-arc spray, metallic zinc may be applied to plastic to provide a conductive surface or shielding. This two-step process first roughens the plastic surface by grit-blasting or sanding, and then spray-coats with molten zinc, either manually or with robotics.

20. Prepared Feeds Manufacturing

NAICS: 311119, Other Animal Food Manufacturing

311611, Animal (except Poultry) Slaughtering

SIC: 2048, Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats

SCC: 28050, Miscellaneous Area Sources, Agricultural Production– Livestock

The Prepared Feeds Manufacturing source category includes establishments engaged primarily in manufacturing prepared feeds and feed ingredients and adjuncts for animals and fowls, except dogs and cats. Included in this industry are poultry and livestock feed and feed ingredients, such as alfalfa meal, feed supplements, and feed concentrates and feed premixes. Also included are establishments primarily engaged in slaughtering animals for animal feed.

Trace minerals and other animal feed supplements are blended in a a mixer with bulk ingredients (corn, soy, etc.) according to a formula. The primary form of manganese incorporated is Manganous oxide (60% manganese). Manganous sulfate (27% manganese) is also used. The manganous compounds are either added in a pure form, or are combined with other metallic nutrients in ingredients known as Trace Minerals. Manganese is a nutrient, which is essential to the growth of animals. Manganese is included in animal feeds for virtually all of the primary species. Manganese is required by poultry to prevent perosis, insure hatchability, egg production, and eggshell strength. Manganese is needed by ruminants to guard against breeding difficulties. In swine, manganese is necessary for maximum growth and lean to fat ratio. Depending on the growth state of the animal and the species, manganese is added at a rate of 1 to 20 milligrams per pound of diet.

In a conventional feed mill the ingredients are mixed, ground and heated with steam to a temperature in the range 65-85°/C. The mixture is then passed through a pellet mill where it is formed into cylindrical pellets of various sizes, depending on the type of animal for which they are intended. The pellet mills are equipped with cyclone dust collectors which control particulate matter emissions. What is collected in the dust collector is then recycled back into the manufacturing process. Any emissions that do escape the dust collector (due to the inefficiency of the equipment) have trace minerals (including heavy metals) present in the same ratio as it was added. Feed formulas that have high mineral/heavy metal content will produce dust that has manganese particulate in the same percentage.

While the majority of feed is shipped in bags, there is some that is loaded onto bulk trucks for direct delivery to a customer. Fugitive particulate matter emissions result from the loading process. The percentage of manganese in the particulate is, again, representative of the original feed mix formula.

21. Primary Copper Smelters

NAICS: 3331411, Primary Smelting and Refining of Copper

SIC: 3331, Primary Smelting and Refining of Copper

SCC: 303005, Industrial Processes, Primary Metal Production, Primary Copper Smelting

Copper concentrate is shipped to primary copper smelters by trucks, rail cars and in some cases, slurry pipelines. All smelters use flash smelting technology. Once the copper concentrate is received at the smelter, it must be further processed before feeding it to the flash smelting furnace. Each smelter operates a combination of crushers and mills to obtain the proper size material for feeding to the furnace. The copper concentrate is mixed with fluxes (materials that facilitate formation of slag containing iron oxides and other impurities). The moisture content of the copper concentrate is reduced by passing the copper concentrate through either a fluidized bed dryer or rotary dryer.

The prepared copper concentrate and finely ground fluxes are injected together with oxygen and preheated air into the furnace. The furnace uses the heat generated from the partial oxidation of the sulfide content in the copper concentrate to provide most, if not all of the energy required for the smelting process. Supplemental heat is supplied, as needed, using oil-fired or gas-fired burners to maintain the required smelting temperature. The resulting molten material collects in a bath at the bottom of the furnace. This molten bath separates into two layers. The lighter density material layer is called "slag" and contains iron silicates and other impurities. The heavier density material layer is called "copper matte" and contains up to 65 percent copper in the form of copper sulfide. The off-gases exhausted from the furnace contain concentrated sulfur dioxide. These off-gases are treated in a contact sulfuric acid plant before being vented to the smelter main stack. The molten copper matte and slag are removed form the flash smelting furnace through tapholes along the side of the furnace.

Converting is an oxidation process that removes most of the sulfur, iron, and other impurities in the copper matte to produce blister copper. Batch copper converting is performed in 8-to-12 hour batch cycles using 3 to 5 large refractory-lined cylindrical steel vessels mounted on trunnions at either end and aligned in a row inside the converter building. Operation of the converters is staggered such that, at any given time, not all of the converters are being used for blister copper production, and those that are on-line are operating in different stages of the converting cycle. The batch converting cycle follows a sequence of steps involving charging of molten matte from the furnace to the converter, blowing oxygen through the molten bath, skimming off slag, and finally pouring the blister copper at the end of the cycle. Material is added to or removed form each converter using large ladles which are positioned and transported using a traveling overhead crane.

After converting, the blister copper is further processed by fire refining to produce anode copper. Fire refining is conducted in a cylindrical vessel similar to a batch copper converter. Flux is added and air is blown through the molten blister copper mixture to oxidize the copper and any remaining impurities. The impurities are removed as slag. The remaining copper oxide is then subject to a reducing atmosphere to form a very high purity copper. The fire-refined copper is then cast into anodes for shipment to another facility for further electrolytic refining.

22. Primary Metals Products Manufacturing

NAICS: 331221, Rolled Steel Manufacturing (pt)

332618, Other Fabricated Wire Product Manufacturing (pt)

SIC: 3399, Primary Metal Products, Not Elsewhere Classified

SCC: 30399999, Industrial Processes, Primary Metal Production, Other Not Classified

The Primary Metal Products Manufacturing source category includes establishments primarily engaged in manufacturing primary metal products that are not elsewhere classified. This description includes aluminum atomized powder, steel balls, nonferrous metal brads, metal flakes, powdered iron, laminating steel for the trade, nonferrous metal nails, metal paste, silver and other metal powder except for artists' materials, reclamation of ferrous metals from clay, recovery of iron ore from open hearth slag, and nonferrous metal spikes, staples, and tacks.

Processes in this source category can include electroplating, electropolishing, floor cleaning, grinding, heat treating, impact deformation, machining, metal spraying, painting, plasma arc machining, polishing, pressure deformation, salt bath descaling, soldering/brazing, solvent degreasing, paint stripping, metallic coating stripping, testing, thermal cutting, washing, and welding. The specific operations of primary metal products manufacturing will differ from facility to facility. The following discussion is a generalization of the processes that take place at the establishments in this source category.

The raw material (e.g. bar stock, wire, rod, sheet stock, plates) undergoes some type of metal shaping process, such as impact or pressure deformation, machining, or grinding. In these operations, the raw material is shaped into intermediate forms for further processing or into final forms for assembly and shipment. Sites typically clean and degrease the parts between some of the shaping operations to remove lubricants, coolants, and metal fines. Sites may also perform heat treating operations to alter the physical characteristics of the part.

After shaping, the part typically undergoes some type of surface preparation operation, such as alkaline cleaning, acid pickling, or barrel finishing. The specific operation used depends on the subsequent unit operations to be performed and the final use of the products.

Metal and organic deposition operations typically follow shaping and surface preparation operations, and precede surface finishing and final assembly operations. Electroplating operations typically follow alkaline and acid treatment operations, while painting operations typically follow phosphate conversion coating and alkaline treatment operations.

Surface finishing operations are typically performed after shaping and surface preparation operations. Some surface finishing operations are performed after metal deposition operations. Some surface finishing operations are also performed prior to organic coating operations.

Disassembly operations may be performed as the first step in the rebuilding process. Assembly operations, on the other hand, are performed at many steps of the manufacturing and rebuilding process. Assembly operations prepare the final product. Assembly may also involve some final shaping and surface preparation.

23. Valves and Pipe Fittings

NAICS: 332919, Other Metal Valve and Pipe Fitting Manufacturing

332999, All Other Miscellaneous Fabricated Metal Products Manufacturing

SIC: 3494, Valves and Pipe Fittings, Not Elsewhere Classified

SCC: 309002, Industrial Processes, Fabricated Metal Products, Abrasive Blasting of Metal Parts

3090019, Industrial Processes, Fabricated Metal Products, General Processes

3090050, Industrial Processes, Fabricated Metal Products, Welding

309030, Industrial Processes, Fabricated Metal Products, Machining Operations

3099999, Industrial Processes, Fabricated Metal Products, Other Not Classified

The Valves and Pipe Fittings source category includes establishments primarily engaged in manufacturing metal valves and pipe fittings, flanges, and unions, with the exception of from purchased pipes. Machining, grinding, welding, and shot-peaning processes are used in the manufacture of valves and pipe fittings.

Grinding involves removing stock from a workpiece by using abrasive grains held by a rigid or semirigid binder. Grinding shapes or deburrs the workpiece. The grinding tool is usually a disk, but can also be a cylinder, ring, cup, stick, strip, or belt. The most commonly used abrasives are aluminum oxide, silicon carbide, and diamond. The process may use a grinding fluid to cool the part and remove debris or metal fines. Wastewater generated during grinding includes spent coolants and rinses. Metal-working fluids are spent for a number of reasons, including increased biological activity or decomposition of the coolant additives. Rinse waters are typically assimilated into the working fluid or treated on site.

Machining involves removing stock from a workpiece as chips by forcing a cutting tool against the workpiece. This includes machining processes such as turning, milling, drilling, boring, tapping, planing, broaching, sawing, cutoff, shaving, shearing, threading, reaming, shaping, slotting, hobbing, and chamfering. Machining processes use various types of metal working fluids, the choice of which depends on the type of machining being performed and the preference of the machine shop. The fluids can be categorized into four groups: straight oil (neat oils), synthetic, semisynthetic, and water-soluble oil. Machining operations generate wastewater from working fluid or rinse water discharge. Metal working fluids are periodically discarded because of reduced performance or development of a rancid odor. After machining, parts are sometimes rinsed to remove coolant and metal chips. The coolant reservoir can be rinsed, and the rinse water is added to the working fluid.

Welding involves joining two or more pieces of material by applying heat, pressure, or both, with or without filler material, to produce a metallurgical bond through fusion or recrystallization across the interface. Included in this definition are gas welding, resistance welding, arc welding, cold welding, electron beam welding, and laser beam welding. Welding typically is a dry process, except for the occasional use of contact cooling waters or rinses.

Shot-peaning, also known as abrasive blasting, involves removing surface films from a workpiece by using abrasive directed at high velocity against the workpiece. Abrasive blasting includes bead, grit, shot, and sand blasting, and may be performed either dry or with water. The primary applications of wet abrasive blasting include: removing burrs on precision parts; producing satin or matte finishes; removing fine tool marks; and removing light mill scale, surface oxide, or welding scale. Wet blasting can be used to finish fragile items such as electronic components. Also, some aluminum parts are wet blasted to achieve a fine-grained matte finish for decorative purposes. With abrasive blasting operations, the water and abrasive are typically reused until the particle size diminishes due to impacting and fracture.