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Title III Section 313 Release Reporting Guidance

Estimating Chemical Releases From Textile Dyeing

Estimating Chemical Releases From Textile Dyeing

Facilities engaged in textile dyeing may be required to report annually any releases to the environment of certain chemicals regulated under Section 313, Title III, of the Superfund Amendments and Reauthorization Act (SARA) of 1986. If your facility is classified under SIC codes 20 through 39 (textile dyers generally fall under SIC code 22) and has 10 or more full-time employees, for calendar year 1987 you must report all environmental releases of any Section 313-listed chemical or chemical category manufactured or processed by your facility in an amount exceeding 75,000 pounds per year or otherwise used in an amount exceeding 10,000 pounds per year. For calendar years 1988 and 1989 (and beyond), the threshold reporting quantity for manufactured or processed chemicals drops to 50,000 and 25,000 pounds per year, respectively.

This document has been developed to assist textile dyers in the completion of Part III (Chemical Specific Information) of the Toxic Chemical Release Inventory Reporting Form. Included herein is general information on toxic chemicals used and process wastes generated, along with several examples to demonstrate the types of data needed and various methodologies available for estimating releases. If your facility performs other operations in addition to textile dyeing, you must also include any releases of toxic chemicals from these operations.

Step One

Determine if your facility processes or uses any of the chemicals subject to reporting under Section 313.

A suggested approach for determination of the chemicals your facility uses that could be subject to reporting requirements is to make a detailed review of the chemicals and materials you have purchased. If you do not know the specific ingredients of a chemical formulation, consult your suppliers for this information. If they will not provide this information, you must follow the steps outlined to handle this eventuality in the instructions provided with the Toxic Chemical Release Inventory Reporting Form.

The list presented here includes chemicals typically used in textile dyeing that are subject to reporting under Section 313. This list does not necessarily include all of the chemicals your facility uses that are subject to reporting, and it may include many chemicals that you do not use. You should also determine whether any of the listed chemicals are created during processing at your facility. For example, using an alkaline sodium salt to raise the pH of acidic solutions of sulfate will create sodium sulfate (solution), which is a listed substance.

Dyes specifically listed: Disperse Yellow 3, Acid Green 3, Auramine, Basic Red 1, Basic Violet 10, Basic Green 4, Direct Brown 95, Direct Black 38

Cobalt-containing dyes: For example, some neutral premetallized dyes

Copper-containing compounds: Including dyes and fixatives

Chromium-containing compounds: Including dyes, oxidizing agents, and mordants/fixatives

Oxidation bases: Catechol, p-phenylenediamine, aniline black

Carriers, swelling agents: Biphenyl

Dyeing aids: Sodium hydroxide (caustic soda), sodium sulfate (Glauber's salt), formaldehyde, ethylene glycol, perchloroethylene, tetrachloroethylene

Flame retardants: Aluminum oxide

pH adjusters: Ammonium sulfate, phosphoric acid

Step Two

Determine if your facility surpassed the threshold quantities established for reporting of listed chemicals last year.

You must submit a separate Toxic Chemical Release Inventory Reporting Form for each listed chemical that is "manufactured," "processed," or "otherwise used" at your facility in excess of the threshold quantities presented earlier. Manufacture includes materials produced as byproducts or impurities. Toxic compounds that are incorporated into your products (for example, dyes that are incorporated into textile articles) would be considered "processed" because they become part of the marketed finished product. Degreasing solvents, cleaning agents, and other chemicals that do not become part of the finished product would be considered "otherwise used."

The amount of a chemical processed or otherwise used at your facility represents the amount purchased during the year, adjusted for beginning and ending inventories. To ascertain the amount of chemical in a mixed formulation, multiply the amount of the mixture (in pounds) by the concentration of the chemical (weight percent) to obtain the amount of chemical processed.

Example: Calculating annual use of perchloroethylene through purchases and inventory changes.

Opening stock	*5,000 lb*
Plus purchases during year	*12,000 lb*
	17,000 lb
Less closing stock	*6,000 lb*
Total use	*11,000 lb*

A listed chemical may be a component of several formulations you purchase, so you may need to ask your supplier for information on the concentration (percentage) of the chemical in each. For chemical categories, your reporting obligations are determined by the total amounts of all chemicals in the category.

Example: Calculating annual use of chromium compounds.

15,000 lb chromium dye A (containing 80% chromium compound)	*12,000 lb*
10,000 lb chromium dye B (containing 40% chromium compound)	*4,000 lb*
25,000 lb chromium dye C (containing 80% chromium compound)	*20,000 lb*
30,000 lb sodium dichromate (93% technical grade)	*27,900 lb*
	63,900 lb

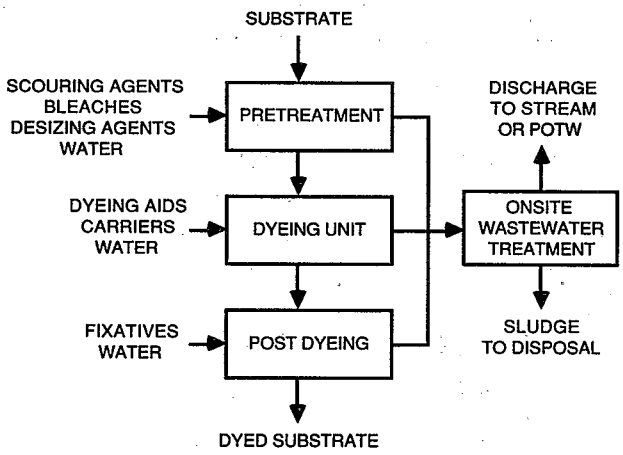
The processing threshold applies because these compounds, including the sodium dichromate, are incorporated into the textile fiber. The 1987 processing threshold of 75,000 pounds is not exceeded, however.

You must complete a report for each chemical for which a threshold is exceeded. The thresholds apply separately; therefore, if you both process and use a chemical and either threshold is exceeded, you must report for both activities. If neither threshold is exceeded, no report is needed.

Step Three

Identify points of release for the chemical(s) subject to reporting.

An effective means of evaluating points of release for listed toxic chemicals is to draw a process flow diagram identifying the operations performed at your facility. The figure below is an example flow diagram for textile dyeing. Because each facility is unique, you are strongly urged to develop a flow diagram for your particular operations that details the input of materials and chemicals and the waste sources resulting from the operation of each unit.



Example Flow Diagram of Textile Dyeing

The primary release of any of the chemicals you use is likely to occur in the wastewater from the dyeing process. If wastewater is treated on site, you may also have sludge or other wastes containing the chemical. Other releases may come from discarded containers or samples, equipment washings, or, in some cases, volatilization to the air. Your reporting must account for all releases.

Step Four

Estimate releases of toxic chemicals.

After all of the toxic chemicals and waste sources have been identified, you can estimate the releases of the individual chemicals. Section 313 requires that releases to air, water, and land and transfers to offsite facilities be reported for each toxic chemical meeting the threshold reporting values. The usual approach entails first estimating releases from waste sources at your facility (that is, wastewater, air release points, and solid waste) and then, based on the disposal method used, determining whether releases from a particular waste source are to air, water, land, or an offsite disposal facility.

In general, there are four types of release estimation techniques:

- **Direct measurement**
- **Mass balance**
- **Engineering calculations**
- **Emission factors**

Descriptions of these techniques are provided in the EPA general Section 313 guidance document, Estimating Releases and Waste-Treatment Efficiencies for the Toxic Chemical Release Inventory Form.

Provisions of the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, and other regulations require monitoring of certain waste streams. If

available, data gathered for these purposes can be used to estimate releases. When only a small amount of direct measurement data is available, you must decide if another estimation technique would give a more accurate estimate. Mass balance techniques and engineering assumptions and calculations can be used in a variety of situations to estimate toxic releases. These methods of estimation rely heavily on process operating parameters; thus, the techniques developed are very site-specific. Emission factors are available for some industries in publications referenced in the general Section 313 guidance document. Also, emission factors for your particular facility can be developed in-house by performing detailed measurements of wastes at different production levels.

Toxic Releases Via Wastewater

You are unlikely to have wastewater monitoring data specific to most of the dyes or other chemicals you process or use. In the absence of such data for wastewater, you can estimate the release in one of the following ways.

1) Release from batch or continuous dyeing

"Loss" of dye in process water can be calculated as dye processed less dye exhausted onto fiber:

Amount of dye lost to water =

amount of dye used x

(1 – fraction exhaustion)

The large number of dye baths in a year and the variation of exhaustion with dyeing conditions make this a complicated analysis. An acceptable simplified approach is to apply an estimated average percentage of exhaustion for the dyes processed instead of making individual calculations for each dye bath. The percentage exhaustion for a dye may be based on your own measurements, manufacturer's data, or published information.

If a continuous dyeing or printing process is operated, add any amount of unused dye or printed paste removed from the process. For the latter, include estimates of losses in screen washing. Your estimate should be based on knowledge of the volume of unused bath and the concentration of chemicals in the bath.

2) Release of nonvolatile and nonsubstantive dyeing aids

Most dye bath chemicals other than the dyes themselves are not retained in the fibers and most materials used in "wet processes" will be lost to water. Water releases can be calculated as the amount used less any other known losses. For example, if "empty" drums still containing 1 percent of a dye carrier are landfilled and the only other release is in the process water, 99 percent of the dye carrier would be lost to water.

3) Release of metal-containing compounds

When compounds contain chromium, copper, cobalt, or other metals, releases should be reported for the metal only. If monitoring data are available for any of these metals, you can calculate the release as:

Amount of metal released to water =

concentration in wastewater x

daily volume of wastewater x

days/year for which data apply

Review all monitoring data for the metal to determine an average representative concentration to use in this calculation. If no monitoring data exist, calculate releases based on exhaustion data, but adjust for the metal content. For example, in the case of a chromium-complex dye:

Amount of chromium released to water =

weight of dye x

weight percent of chromium x

(1 – fraction exhaustion)

Your estimate of the release of each metal to water must take into consideration each compound containing that metal.

4) *Releases of acids and bases*

If a listed mineral acid or base is used at your facility but is effectively neutralized in use or during wastewater treatment (to pH 6 to 9, as required by the effluent guidelines for most textile dyers), no release quantities should be reported for the acid or base.

Sodium sulfate solution, a listed substance, is used as a processing aid, whether its source is as a diluent in the purchased dyes or as sodium sulfate purchased separately. Sodium sulfate also may be manufactured during the neutralization of sulfuric acid. Because the threshold for reporting is lower for used substances than for manufactured substances, in nearly all cases you should focus on the amount of sodium sulfate you use when determining whether a threshold is exceeded.

Total release equals the sum of sodium sulfate content in each dye or other formulations and the sodium sulfate produced by neutralization of sulfuric acid. The quantity of the latter can be calculated as:

Amount of sodium sulfate =

amount of sulfuric acid used x

142 (the molecular weight of sodium sulfate) ÷

98 (the molecular weight of sulfuric acid)

5) *Release after treatment*

If wastewater treatment occurs on site, you should adjust the total losses to yield "release" for purposes of reporting. If available, use actual plant operating data on removal efficiency. Published data also may be used if available for the dye or other chemical treated by the method used at your plant (for example, biological wastewater treatment). The amount of chemical released to water after treatment can thus be calculated as:

Amount of chemical released to water =

amount lost in process water x

(1 – treatment efficiency)

If no data are available, assume that the treatment does not remove the chemicals (that is, the treatment efficiency is zero).

Toxic Releases Via Solid Waste

During wastewater treatment, a listed chemical may be transferred to sludge. For the listed metals, loss in the sludge may be calculated as:

Amount of metal in sludge =

amount lost from process –

amount lost in water

Alternatively, you may calculate the quantity directly if you have data on the concentration of metals in your sludge.

For organic chemicals in general, some degradation may occur during treatment, which means that all of the chemical removed from water is not transferred to the sludge. The amount of organic compounds in the sludge may be estimated by using measured data or by subtracting the amount degraded from the total amount removed in treatment. Removal may be determined from operating data, and the extent of biodegradation may be obtained from published studies.

Toxic Releases to Air

Some of the chemicals you use are volatile enough so that air releases will occur either during process steps or during waste treatment. Air releases are most easily estimated by subtracting all other known releases from the amount used.

Example: Estimating perchloroethylene air releases from dry cleaning.

In 1987, a plant used 20,000 pounds of perc to dry clean samples. Manifests show that 5,000 pounds of spent perc was sent offsite for disposal. Therefore, air releases were:

Amount of perc released to air =

20,000 lb used –

5,000 lb to offsite disposal

= 15,000 lb

Other Toxic Releases

Other wastes in textile dyeing from which toxic chemicals may be released include:

- **Residues from pollution control devices**
- **Wash water from equipment cleaning**
- **Product rejects**
- **Used equipment**
- **Empty chemical containers**

Releases from these sources may already have been accounted for, depending on the release estimation methods used. These items (and any other of a similar nature) should be included in your development of a process flow diagram.

The contribution of sources of wastes such as cleaning out vessels or discarding containers should be small compared with process losses. If you do not have data on such sources (or any monitoring data on overall water releases), assume up to 1 percent of vessel content may be lost during each cleaning occurrence. For example, if you discard (to landfill) "empty" drums that have not been cleaned, calculate the release as 1 percent of normal drum content. If the drums are washed before disposal, this may contribute 1 percent of the content to your wastewater loading.

Step Five

Complete the Toxic Chemical Release Inventory Reporting Form.

After estimating the quantity of each chemical released via wastewater, solid waste, and air emissions, you must determine the amount of each chemical released to water, land, or air or transferred to an offsite disposal facility. This determination will be based on the disposal method you use for each of your waste streams. Enter the release estimates for each chemical or chemical category in Part III of the Toxic Chemical Release Inventory Reporting Form. Also enter the code for each treatment method used, the weight percent by which the treatment reduces the chemical in the treated waste stream, and the concentration of the chemical in the influent to treatment (see instructions). Report treatment methods that do not affect the chemical by entering "0" for removal efficiency.

For More Information

Emergency Planning and Community Right-to-Know Hotline	(800) 535-0202 or (202) 479-2449 (in Washington, D.C. and Alaska)
Small Business Ombudsman Hotline	(800) 368-5888 or (703) 557-1938 (in Washington, D.C. and Virginia)

The EPA brochure, Emergency Planning and Community Right-to-Know Act, Section 313 Release Reporting Requirements (EPA 560/4-88-001) presents an overview of the new law. It identifies the types of facilities that come under the provisions of Section 313, the threshold chemical volumes that trigger reporting requirements, and what must be reported. It also contains a complete listing of the chemicals and chemical categories subject to Section 313 reporting. The EPA publication, Estimating Releases and Waste-Treatment Efficiencies for the Toxic Chemical Release Inventory Form (EPA 560/4-88-002), presents more detailed information on general release estimation techniques than is included in this document.

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