JULY 1993

TOXIC RELEASE INVENTORY DATA VERIFICATION: EVALUATION OF TEXTILE, WOOD FURNITURE, AND COATINGS MANUFACTURING FACILITIES DATA

FINAL REPORT

Prepared for:

North Carolina Department of Health, Environment, and Natural Resources
Pollution Prevention Program
Raleigh, North Carolina

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RTI Project Number
5495-00

State of North Carolina
Contract No. W-3025

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1.0 INTRODUCTION

In 1986, the Environmental Protection Agency (EPA) introduced a Federal law that required certain facilities to report their annual releases of toxic materials to the environment. This law, the Emergency Planning and Community Right-to-Know Act, is described in Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA). It states that those facilities meeting certain criteria are required to complete and file the Toxic Release Inventory (TRI) Reporting Form annually. The criteria are as follows and all must apply:

- The facility has 10 or more full-time employees.
- The facility conducts manufacturing operations within the Standard Industrial Classification (SIC) codes 20 through 39.
- The facility manufactures, processes, or in any other way uses any of the listed toxic chemicals in amounts greater than the threshold quantities.

The threshold quantities for manufacturers and processors are:

- 75,000 lb during the 1987 calendar year,
- 50,000 lb during the 1988 calendar year, and
- 25,000 lb during the 1989 calendar year and in subsequent years.

The threshold quantities for users are as follows:

- 10,000 lb during the 1987 calendar year and in subsequent years.

The Section 313 toxic chemical list contains over 300 specific chemicals and about 20 chemical categories. However, these numbers may fluctuate yearly due to the addition or removal (delisting) of chemicals. Facilities are required to complete one TRI form for each listed chemical that is manufactured, processed, or used in quantities exceeding the threshold levels. Specifically, the forms contain the quantities of each chemical that are being released to air, water, and land. These forms cover the activity of the preceding calendar year and are filed by July of each year. Facilities are required to submit TRI forms to EPA and their State governments.

In this way, TRI provides a complete, useful inventory of the toxic chemicals that are being released to the environment. Consequently, TRI data are used in a wide variety of efforts, including those with significant impacts on environmental priorities and policy at both the Federal and State levels. It is crucial, therefore, that the TRI data be as accurate as possible.

The two primary objectives of this project are: (1) to determine the accuracy of, and identify errors in, TRI reporting data in the State of North Carolina for the years 1987 through 1990, and (2) to develop computer methodologies that can be used to compare TRI data with data in other environmental data bases. This report contains the results obtained from implementing the first objective. A separate report documents the results from the second objective.

The purpose of this report is to describe the methodologies developed to support the data verification effort, the gathered information, and the results. Section 2.0 describes the process used by the Research Triangle Institute (RTI) to select the industries to be investigated. It describes the telephone interviews that were conducted to gather preliminary information on each facility. Additionally, Section 2.0 contains the site selection criteria and procedures followed during the site visits. Section 3.0 presents specific information on the processes involved in each of the selected industries. Section 4.0 summarizes the results obtained from the telephone interviews and site visits. Section 5.0 presents conclusions and includes recommendations for improving the reliability of the TRI data, and Section 6.0 is a bibliography of documents used during the project.

2.0 METHODOLOGY

2.1 Industry Selection

Each year, there are over 800 facilities in North Carolina that are required to complete and file the TRI form. RTI, in concurrence with the Office of Waste Reduction (OWR), selected facilities within each of the three major SIC code groups represented in North Carolina:

- Major group 22, facilities involved in the manufacture of textile mill products;
- Major group 25, facilities engaged in manufacturing furniture and fixtures; and
- Major group 28, facilities that manufacture chemicals and allied products.

To further narrow the selection process, RTI chose the specific SIC codes 226, 2511, and 2851 because they included the largest number of facilities within the three major groups. There were 57 companies with SIC code 226, 93 companies with SIC code 2511, and 20 companies with SIC code 2851.

Using the Waste Reduction Management System's (WRMS) data base, TRI data for each of the 168 facilities were retrieved for the 1987 through 1990 reporting years. Each form contained the following information (see Appendix A):

- facility name and address;
- facility contact and telephone number;
- EPA, National Pollutant Discharge Elimination Stystem (NPDES), TRI, and air quality identification numbers;
- name of receiving waterbody or publicly owned treatment works (POTW); and
- names and amount of emissions for each chemical released to the fugitive, stack, water, land, POTW, and offsite release categories (although Form R contains the underground injection release category, it is not contained in the WRMS data base).

Each form for each facility was studied for certain trends, such as omissions of fugitive and/or stack releases for highly volatile chemicals and companies showing no reporting for certain years. Also, those companies showing dramatic increases or decreases in emissions from year to year were noted.

2.2 Telephone Interviews

To obtain the maximum amount of information efficiently, telephone interviews of all 168 facilities were conducted. A preliminary letter was sent to each facility from the North Carolina Division of Emergency Management (see Appendix B) requesting voluntary participation in the interviews. The letter outlined the objectives of the project and how the companies could benefit by participating.

The interview questions were designed to gather consistent and uniform information from each facility (see Appendix C). Each company was assigned a code to ensure confidentiality. Before a facility was called, its TRI data were carefully studied and any concerns or pertinent questions were noted. Each telephone call began with a brief description of the TRI data verification project and RTI's role in the project. Additionally, a reference was made to the aforementioned letter and the pledge of confidentiality was reiterated.

The telephone interviews were conducted to achieve three goals. First, they provided general information on how the company approached TRI reporting requirements. Second, the survey provided information concerning the main operations at each facility and the TRI chemicals associated with these processes. This information, along with the WRMS data, helped to identify potential reporting errors. Third, the survey aided in determining which facilities would be willing to participate in a site visit.

2.3 Site Visits

During the telephone interviews, each facility representative was asked to participate in a site visit. The representatives were told that the sites would be selected randomly, and that information obtained from the site visits would not be in any way identified with the names of the facilities in the final report.

Those that agreed to participate in a site visit were grouped by industry. The facilities in each of the three groups were further divided into large and small facilities based on the average number of employees in each industry. This information may be helpful in determining if there is any correlation between the size of the facility and the quality of its TRI data.

Furthermore, it was decided that it would be beneficial to determine a specific criterion for each industry to represent the different types of processes in use at the facilities interviewed. Therefore, the textile industry was grouped into those facilities that finished apparel and those that finished nonapparel goods, such as upholstery or drapery fabric. The coatings industry was grouped to reflect their manufacture of solvent-based products or water-based products. The furniture industry was divided into those that produce high-, medium-, and low-quality furniture. Level of quality was determined by the number of steps involved in the finishing processes.

At least 10 percent of those facilities participating in the telephone interviews were selected for site visits. Thus, 10 facilities were chosen for site visits from the textile finishing industry. Of the 10, half were small facilities employing less than 300 people and the other half were large facilities. Four of the textile facilities finished nonapparel goods while the rest finished apparel goods. Five facilities were chosen from the coatings industry. Three were smaller facilities with less than 67 employees and two were larger. They manufactured solvent-based as well as water-based coatings. Ten facilities were chosen for site visits from the furniture manufacturing industry. Five of the ten were considered small facilities employing less than 343 people and the rest were larger facilities. Five produced medium-end furniture, three produced high-end furniture, and two produced low-end furniture products.

Each facility selected for a site visit was contacted by telephone to set a date for the visit. Because some of the contacts needed to obtain clearance from their supervisors or their corporate departments, a cover letter describing the project and its goals was sent to each facility. A site visit agenda was also sent for their review. Appendix D contains a copy of this correspondence.

Each site visit consisted of five phases. During the first phase, the objectives and goals of the project were discussed. It was explained that the site visit could aid the facility in improving the quality of their TRI data in three ways:

- by identifying sources of emissions that may have to be reported;
- by determining if facility estimations and data have been reasonable in past reporting years; and
- by addressing any problems the facility may have with TRI reporting.

At this time, the facility representatives were assured that the information gathered at the site visit would be kept confidential from government agencies and competing firms within that industry.

The second phase of each site visit consisted of a discussion of the overall processes and operating procedures at the plant. Some facilities produced process flow diagrams that not only described the processes at the plant but displayed the plant's physical layout as well. The facility's use of TRI chemicals was also discussed. Processing changes and waste reduction techniques that may have eliminated or reduced the use of SARA 313 chemicals were addressed.

During the third phase of the visit, a full tour of the plant was conducted. The tour usually began in the area where raw materials are received, proceeded through the process areas, and ended with the inspection and packaging areas. Warehouses and bulk storage tank areas were also visited, as well as wastewater treatment processes. During the tour, the processes where TRI chemicals were manufactured or used were noted. Additionally, possible sources of releases such as lagoons, holding ponds, loading areas, and other nonprocess activities were identified.

The fourth phase of the site visit consisted of a review of the TRI reports submitted for the 1987 through 1990 reporting years. Supporting documentation such as calculations, material safety data sheets (MSDSs), and inventory information, were also examined. The facility's reports were compared to the WRMS data to determine if they agreed. The facility representative was asked to describe the method that was used to calculate the releases. Some facilities had designed a database or spreadsheet to aid them in completing the reports. At this time, identified errors would be discussed and documented.

An exit interview was conducted during the final phase of the site visit. The quality of the plant's TRI data was discussed and, if applicable, suggestions were made to improve the reporting. If revisions to the 1987 through 1990 reports were necessary, instructions for revisions were given to the facility representative. Followup responsibilities were determined as well. Any comments the representative may have had were noted at this time. The OWR had supplied brochures to be given to each facility representative. The brochures described the Pollution Prevention Program (PPP), the services they offer, as well as a list of publications that are available to industry. Excerpts from a sample OWR/PPP publication, *Accomplishments of North Carolina Industries: Case Summaries*, were given to each facility representative. The excerpts described pollution prevention techniques employed at various similar facilities around the State.

After each site visit, a report was prepared summarizing the information obtained during the visit. Reports from all 25 facility site visits are contained in Appendix E. The first part of each report describes the background of the facility and its process information. TRI chemical usage at the facility is discussed in the second part. The Comments section describes how the facility completes Form R, any errors that were identified, and any pollution prevention activities employed at the facility that have affected TRI chemical releases.

As a final step, a thank-you letter containing any followup information the facility may have requested was sent to the facility representative.

3.0 INDUSTRY CHARACTERIZATION

3.1 Textiles

Major SIC code 226 consists of finishing plants for natural and synthetic fibers. Natural fibers include cotton and silk; synthetic fibers include rayon, polyester, acrylic, acetate, and nylon. Of the 57 companies surveyed, most were fabric dyeing and finishing plants. However, some of the companies finished fabrics only or dyed yarns only prior to spinning or weaving.

Most dyeing and finishing plants receive fabric in woven form that must be prepared prior to the dyeing and finishing processes. The size that was applied to the fibers to facilitate weaving is removed in a sulfuric acid solution or by using enzymes. The fabric may then be scoured in a hot alkaline solution to remove oils and other impurities. Mercerizing the fabric with caustic results in increased tensile strength and surface luster and improves the dyeability of the fabric. Oxidizing agents, such as hydrogen peroxide, are used to bleach the fabric to remove stains.

When the fabric is ready, basic, acid, direct, and disperse dyes may be used in atmospheric becks and jets or pressurized jets to successfully dye it. In pad dyeing, reactive dyes are used to dye the fabric. Package dyeing or slasher dyeing are processes used to dye yarns or filaments. After the fabric is rinsed, colored patterns may be printed on the fabric using roller printers.

Various chemical finishes may then be applied to the fabric, such as softeners or water-repellent or fire-retardant finishes. Latex foams may be applied to provide a protective coating for the fabric. Scotchguard finish may be applied to upholstery or drapery fabric. After drying, the fabric may be subjected to various mechanical finishes such as calendering, napping, shearing, and sueding to improve the texture of the fabric. Finally, the goods are inspected and solvents are used to remove soil stains from the fabric.

Table I lists the wet processes employed at a fabric dyeing and finishing plant, the various TRI chemicals involved in each of the processes, and a description of the significance of each process.

Numerous sources of chemical releases exist at textile dyeing and finishing facilities. Equipment leaks of chemicals are a source of fugitive emissions. Fugitive emissions may also occur when solvents are used to remove stains from fabric or when resins or coatings containing volatile chemicals are applied to the fabric. Stack emissions result from the oven drying of such fabrics. Breathing and working losses from chemical storage tanks due to vapor expansion and contraction may also contribute to stack releases.

Chemicals used in the scouring or dyeing operations remain in the wastewater and are discharged to the POTW or a receiving stream after treatment. If the wastewater is treated, fugitive emissions of the solvent-containing dye carriers from the water may also result. Offsite releases may occur when coated scraps of fabric containing TRI chemicals are disposed of. Some facilities may send still bottoms from onsite recycling of solvents to an offsite location for disposal.

3.2 Coatings

The manufacturers of coatings for wood furniture produce high-solids, low-volatile organic compound (VOC) products; water-based finishes; and solvent-based lacquers, stains, and sealers. Other manufacturers that were surveyed include the producers of architectural coatings, polyester wood finishes, ultraviolet (UV)-curable coatings, polyester gel coatings for bathroom vanities and fiberglass boats, and metal coatings for original equipment manufacturers parts.

A typical manufacturing process might begin with the dispersion of pigment in an oil or resin. High shear, roller (ball), pebble, and sand mills may be used to grind and further disperse the particles. At this point, the mixture might be transferred to a let-down tank where the balance of the solvent is added. The product is adjusted to the proper shade and strength. During the process, the facility may add other constituents such as stabilizers, thickeners, extenders, antifoam, wetting, and antimicrobial agents. The product is filtered, packaged, and shipped in quantities that range from one gallon to a tankerload.

The paint industry is the largest consumer of industrial solvents. Solvents may be used in the coating formulations, for mix vessel cleaning, or for general industrial maintenance. Some of the solvents in use that are relevant to this project include:

TABLE I: TYPICAL TEXTILE FINISHING PROCESSES

PROCESS	TRI CHEMICAL	PURPOSE
Slashing	none	Yarn coated with size (starches) to facilitate weaving
Desizing	sulfuric acid solution	Removes sizing compounds
Scouring	sodium hydroxide[a] perchloroethylene 1,1,1-trichloroethane toluene xylene	Removes waxes, oils, grease, and other impurities
Mercerizing	sodium hydroxide[a]	Improves dyeability of fabric
Bleaching	none	Removes stains
Dyeing	sodium sulfate[b] hydrochloric acid sulfuric acid biphenyl 1,2,4-trichlorobenzene tetrachloroethylene xylene toluene 1,2,4-trimethylbenzene copper, nickel, cobalt	Chemicals used to aid the dyeing process Metals in blue and green dyes and pigments
Printing Binders Humectants	 vinyl acetates butadienes ammonia ethylene glycol	 Helps pigment to stay on fabric Helps keep print paste viscous
Finishing Spotting Flame-retardant Water-repellent Latex coatings Softeners	 tetrachloroethylene 1,1,1-trichloroethane trichlorethylene antimony decabromodiphenyl oxide zinc methanol ammonia xylene formaldehyde	 Removes stains from finished fabric Renders fabric flame retardant Renders fabric water repellent Provides a protective coating for fabric Improves feel of fabric
Miscellaneous	chlorine ethylene oxide	Water treatment Wetting agent

[a]Delisted for the 1989 reporting year.

[b]Delisted for the 1988 reporting year.

- acetone,
- n-butyl alcohol,
- cyclohexane,
- ethyl benzene,
- ethylene glycol,
- glycol ethers,
- methanol,
- methylene chloride,
- methyl ethyl ketone,
- methyl isobutyl ketone,
- styrene,
- tetrachloroethylene,
- trichloroethylene,
- 1,1,1-trichloroethane,
- 1,2,4-trimethyl benzene,
- toluene, and
- xylene.

Other reportable chemicals that the industry uses include:

- ammonia,
- antimony compounds,
- barium compounds,
- cadmium compounds,
- chromium compounds,
- cobalt compounds,
- manganese compounds,
- zinc compounds,
- bis (2-ethylhexyl) phthalate, and
- butylbenzyl phthalate.

Ammonia is used in water-based coatings. The other chemicals are present in pigments and plasticizers.

The facilities have both wall-mounted exhaust fans and vacuum collection hoods to remove vapor and particulate from the workplace. Because much of the formulating, milling, and dispersing is conducted in open vessels, there is a potential for both fugitive and stack emissions to the air. The cleaning of these tanks also contributes to air emissions. Additionally, if the waste solvent generated from tank cleaning is not reused, it may be sent offsite for disposal or recycled onsite in a solvent recovery still. The waste sludge from this process is sent to a disposal facility for fuel-blending or incineration. Bulk solvent storage tanks and process line leaks may also contribute to stack and fugitive emission estimates.

3.3 Wood Furniture

Wood household furniture is one of the industries included under the SIC major group 25, which covers the furniture and fixtures industries. Wood household furniture is primarily classified as furniture commonly used in dwellings with the exception of upholstered furniture. The SIC code for these types of manufacturing facilities is 2511.

Wood furniture manufacturing operations consist of four general processes: raw stock shaping, component assembly, finishing, and unit packing. These processes are used to construct all three furniture grades: low-end, medium-end, and high-end furniture. The less labor-intensive, low-end furniture is usually made of medium-density fiberboard or particleboard. The pieces are painted or have a printed wood grain finish. The very labor-intensive, high-end furniture is constructed of solid wood and wood veneers with the natural wood grain showing through the finish. Medium-end furniture may be made of some combination of particleboard and solid wood and may or may not show the natural wood grain. The furniture industry frequently uses these three classifications to qualitatively describe the furniture they produce.

Facilities can assemble and then finish, or finish and then assemble, the wood furniture. Most of the facilities visited as part of this project assembled and then finished the pieces. The alternative method is used more frequently in Europe or for office furniture that is flatter and more uniform than residential furniture. The shaping of kiln-dried lumber into components for furniture is performed onsite, offsite, or both.

After the components are formed into assorted shapes, they are assembled. The case goods are finished by brushing, dipping, or spraying the finish. The majority of the visited facilities finished the furniture by using a sequence of spray applications.

The furniture finish is applied in a series of steps. Because finishing steps vary in sequence, type, and number, the basic steps and their purposes in a typical order of application are presented here. Intermediate steps, such as sanding and drying, may be interspersed throughout this finishing sequence. First, stain is applied to add uniform color and to accent natural wood grains. Stains are wiped or sprayed onto the pieces. Then a wash coat is applied to help with adhesion, filling, or color uniformity. The wash coat partially seals the wood from subsequent staining applications and prepares the surface for sanding. Filler is applied following the wash coat. It is sprayed and then wiped into the wood to fill open pores of porous woods. Next, sealer is applied; its primary purpose is to provide adhesion, enable sanding, and seal the wood to establish a foundation for artistic enhancement. Sealer is followed by a process known as glazing, shade or pad staining, or spattering. This process adds highlights of color to give the wood integrity. Glaze may be applied manually using brushes, sponges, or rags, or applied using a spray gun. The glaze is wiped by hand after application. At this point, if desired, the furniture can be distressed to obtain a preferred finish. Finally, the piece is given a topcoat or clear coat. Its function is to protect the color coats, enhance the furniture, and provide a durable final finish. One or more topcoats may be applied to the piece depending on the desired finish.

A furniture manufacturer may use any of these finishing steps at least once to achieve the desired enhancement and protection. As mentioned, the order of the finishing sequences and the number of times each coating is applied may vary from manufacturer to manufacturer. The furniture industry classifies the finishing sequences as a long-finishing sequence or a short-finishing sequence. The typical wood furniture manufacturing processes and the TRI chemicals contained in the coatings used for application are listed in Table II.

Although there are many potential VOC emissions sources in wood manufacturing facilities, the finishing sequences provide the primary sources of VOC emissions. Stack emissions occur when furniture is finished in spray booths and dried in curing ovens. Stack emissions also result from breathing and working losses from storage tanks. Fugitive

TABLE II
TYPICAL WOOD FURNITURE MANUFACTURING PROCESSES

PROCESS	TRI CHEMICAL	PURPOSE
Wood cleaning and wax removal	none	To prepare surface for finish
Refinishing/stripping	acetone toluene xylene ethanol butanol methyl ethyl ketone methylene chloride methanol	To repair coats of finish when damaged or when quality of the finish is poor
Staining	methanol	To give translucent color to the wood surface
Painting	toluene glycol ethers vinyl acetate halogenated hydrocarbons	To give opaque color to the wood surface
Finishing	isopropanol	To enhance and protect the wood surface
Brush cleaning, spray gun cleaning	acetone toluene methanol methylene chloride isopropanol	To clean finishing equipment
Glueing, assembly	methyl ethyl ketone methyl isobutyl ketone xylene toluene 111-trichloroethane formaldehyde vinyl acetate	To prepare wood for assembly

emissions may occur in flash-off areas and during cleanup operations. Additionally, leaks in equipment such as valves, seals, and flanges contribute to fugitive emissions. Offsite releases are comprised of solvents sent to a disposal facility for incineration and/or still bottoms resulting from the onsite distillation of spent solvents.

4.0 RESULTS

This section contains the results from both the telephone interviews (Section 4.1) and the site visits (Section 4.2)

4.1 Telephone Interview Results

The results obtained from the telephone interviews are presented in this section. Each subsection summarizes the answers obtained from the three industries to the telephone interview questions (see Appendix C). The telephone interviews were helpful in identifying general errors that facilities may have made. Possible errors revealed during the interviews are summarized in Section 4.1.9.

A total of 168 facilities were asked to participate in a telephone interview. There are 57 companies reporting under SIC code 226, which represents finishing plants in the textile industry. Of that total, 47 facilities participated in the interview, 7 facilities had ceased operating, and 3 facilities did not wish to take part in the interview. Twenty facilities entered SIC code 2851 on Form R. Manufacturers of paints, varnishes, enamels, and allied products are grouped into this category. Eighteen facilities participated and two refused to take part in the questioning. Ninety-three companies report under SIC code 2511, which represents wood furniture manufacture. Of the total, 81 facilities were interviewed, 8 facilities were no longer in operation, and 4 facilities did not wish to be questioned.

4.1.1 Size of Facilities

Participants were asked to specify the number of employees working at the facility. The number of employees at the textile finishing plants ranged from 30 to 7,000, with a median of 300 employees. Approximately 83 percent of the facilities operated three or more shifts per day. The number of employees at the coating facilities ranged from 10 to 290 with an average of 67 employees. Over 75 percent of the facilities operate one shift per day while the remainder operate two per day. The number of employees at the wood furniture manufacturing plants ranged from 55 to 1,125 with an average of 343 employees. The majority of the plants operate one shift per day.

4.1.2 Background of Form Preparer

Participants were asked to give their job title and to describe their job responsibilities. Overall, 51 percent of the respondents represented their facility on safety and environmental issues. Their responsibilities ranged from acquiring discharge permits to completing other State and Federal environmental reports. Thirty-four percent of those surveyed were responsible for operations management. Approximately 14 percent held administrative positions, such as personnel manager and purchasing agent. Only 1 percent of the facilities surveyed rely solely on consulting firms to prepare the entire TRI report. Table III shows the internal divisions each industry relies on to complete the TRI forms.

TABLE III
DIVISION RESPONSIBLE FOR COMPLETING THE TRI FORMS, BY INDUSTRY

DIVISION	TEXTILES	FURNITURE	COATINGS
Safety/Environmental	43%	57%	50%
Administrative	21%	9%	17%
Operations Management	34%	33%	33%
Consultant Use	2%	1%	0%

Fifty-one percent of those contacted indicated they were either employed by the corporate department of their company or received aid in completing the report from this department. Generally, if a respondent was employed by the corporate department, he/she was responsible for completing the TRI reports for all the facilities within that company. If the contacts received aid from the corporate department, it was often in the form of training workshops or custom-designed software packages.

In preparing the TRI report, the respondents indicated that they used the Form R instruction booklet for guidance. However, 60 percent of the respondents supplemented this by attending training seminars which they claimed to be very helpful in completing the TRI report. These seminars were sponsored by EPA, State agencies, corporate departments, and trade organizations, such as National Paints and Coatings Association, American Association of Textile Chemists and Colorists, American Textile Manufacturers Institute, and American Furniture Manufacturers Association. Approximately 40 percent of those contacted also used the toll-free Emergency Planning and Community Right-to-Know Information Hotline to answer questions not addressed in the instruction booklet. Some found this assistance to be helpful, but others felt they received incorrect information from the hotline staff. Nearly 15 percent of those facilities contacted have used a consultant at some time to help complete certain sections of the TRI report. Many anticipate turning over the entire responsibility to consulting firms as Form R becomes more complex and detailed.

4.1.3 Record Management

Those facilities that have submitted TRI reports maintain hardcopy versions in their files. Often they are kept past the minimum 3-year holding period required by EPA. Thirtyfive percent of the facilities keep their TRI reports or their supporting documentation on a computer system. For example, MSDSs and yearly purchasing information are stored in separate data bases. Many of these facilities submit their TRI forms on magnetic media directly to the EPA and, therefore, maintain diskette copies of the reports. Some of these respondents find electronic reporting to be straightforward and hope that the State agency will soon adopt this procedure. The remaining 65 percent submit their yearly reports manually and keep their records in a central location. Some of the respondents feel that EPA's electronic submission software is not user-friendly because it is hard to edit the form once the data have been entered. Others state that the software is not compatible with their personal computers.

One-third of the facilities contacted use computers to aid in reporting. Some use commercially available software packages and others use software designed by their corporate environmental departments. However, most have designed their own data bases, which include the products purchased during the year, their quantities, and the percentage of TRI chemical contained in each product. From this information, the computer can calculate the total amount of each TRI chemical used during the year. The form preparer can then determine which chemicals to report based on whether their amounts are above threshold levels. The remaining two-thirds of the facilities gather information manually. However, all of the furniture manufacturing companies receive computerized purchasing reports from the suppliers of their finishes. These yearly reports detail the quantity of finishes purchased and the amount of TRI chemical in each finish. A summary at the end of the report lists the SARA 313 chemicals and the total amounts purchased of each chemical.

4.1.4 Reporting Burden

Estimates of the amount of time required for preparing the forms range from 1 to 350 hours, with an average of 34 hours. This includes time for gathering all necessary data, reading the instructions, and completing and submitting the forms. Most respondents indicated that they spent significantly more time on the forms in 1987 than they did in 1990 due to their unfamiliarity with the reporting process in the early years. Also, prior to 1989, MSDSs were not as clear and detailed as they became in later years. Their improved clarity has eased industry's reporting burden.

The most difficult part of completing the forms seems to be the correct allocation of the chemicals across the six release categories. Some respondents feel that it is especially difficult to estimate fugitive emissions of certain volatile chemicals. Misinterpretation of the Form R instructions posed some problems for the form-preparers. For example, to determine whether a chemical is manufactured or otherwise used is difficult to do even after reading the detailed instruction section. Another definition that is not presented clearly is that of chemicals belonging to the glycol ether category. Overall, respondents feel that a technical background is necessary to complete the forms accurately and thoroughly.

4.1.5 Reporting Methods Used

There are four general methods for determining emissions of TRI chemicals: measurements, mass balances, emission factors, and engineering judgment. Actual measurements use monitoring equipment to determine the concentration of a chemical in a waste stream. This figure is multiplied by the flow rate or volume of the waste stream to obtain the amount of chemical released. Mass balance estimates are based on the quantity of chemical entering and leaving a process. Emission factors are derived from release information from specific processes and come in two forms. The first expresses releases as a ratio of the amount of chemical released to facility throughput. The second form is the concentration of a chemical in a waste stream. These emission factors are then combined with process throughput or waste stream flow data to provide a release estimate. Finally, any other estimation methods not belonging to the previous three categories are grouped together as engineering judgment. Table IV shows the level of applicability of the four methods for each release category.

TABLE IV
METHODS FOR ESTIMATING RELEASES

Release Category	Actual Measurement	Emission Factors	Mass Balance	Engineering Judgment
Fugitive	N/A	●	◐	○
Stack	◐	◐	○	○
Water	●	N/A	◐	○
Land	◐	N/A	●	○
POTW	●	N/A	◐	○
Offsite	◐	N/A	●	○

The darker shaded circles indicate the most applicable methods while the unshaded circles indicate less applicable methods. Tables V, VI, and VII show which of the four reporting methods each industry uses to calculate chemical releases. A combination of methods may have been used for each release category. For example, a textile finishing facility may use a mass balance to determine the quantity of spotting agent purchased for the year and engineering judgment to make the assumption that the total amount purchased is released as fugitive emissions.

TABLE V
EMISSION CALCULATION METHODS USED BY THE TEXTILE FINISHING INDUSTRY

Release Category	Actual Measurement	Emission Factors	Mass Balance	Engineering Judgment
Fugitive	4	3	11	17
Stack	5	1	11	16
Water	4	0	3	2
Land	1	0	1	0
POTW	5	0	17	5
Offsite	6	0	1	6

TABLE VI
EMISSION CALCULATION METHODS USED BY THE COATINGS INDUSTRY

Release Category	Actual Measurement	Emission Factors	Mass Balance	Engineering Judgment
Fugitive	0	5	4	8
Stack	1	3	2	5
Water	N/R	N/R	N/R	N/R
Land	0	0	0	1
POTW	0	0	1	2
Offsite	8	1	2	1

N/R = No releases were reported for the category.

TABLE VII
EMISSION CALCULATION METHODS USED BY THE
WOOD FURNITURE MANUFACTURING INDUSTRY

Release Category	Actual Measurement	Emission Factors	Mass Balance	Engineering Judgment
Fugitive	0	1	8	36
Stack	0	0	65	37
Water	N/R	N/R	N/R	N/R
Land	N/R	N/R	N/R	N/R
POTW	3	0	0	4
Offsite	4	0	40	12

N/R ≐ No releases were reported for the category.

4.1.6 Internal Use of TRI Data

Facility contacts were asked whether they used the annual TRI data for any other purpose. Sixty-two percent indicated that the data are useful in a number of ways. They can aid the facility in obtaining environmental permits and in preparing other regulatory forms. A number of companies have used the data to participate in EPA's 33/50 Program, which targets 17 highly toxic TRI chemicals for pollution prevention. Gathering the information to prepare the TRI reports has made facilities more aware of the hazardous chemicals that are onsite. This has led some facilities to better educate their employees about product handling and chemical safety.

The majority of respondents, however, stated that the TRI data are useful in determining which chemicals to target for waste reduction. One facility stated that the decision to purchase a solvent recovery still was based on the TRI tracking of spent acetone generation. Waste reduction has been economically beneficial for some companies and has led to reduced reporting of certain TRI chemicals as a result of decreased chemical usage.

The remaining 38 percent of the facilities contacted have little use for the data that are generated. Some facilities stated that waste generation or reduction is tracked independently of TRI results. One individual indicated that TRI thresholds are too high for the program to be of any benefit in waste reduction of some chemicals. For example, chemicals such as heavy metals may be used by many facilities at much lower levels than the TRI threshold levels.

4.1.7 Processing Changes

Many facilities have implemented processing changes or waste reduction techniques that have had a significant impact on their TRI chemical releases. These changes may be a result of waste minimization plans within the facility or they may result from the facility's desire to fall below reporting threshold levels for certain chemicals.

The textile industry has come far in reducing their use of TRI chemicals and their release data effectively show this trend over the years 1987 through 1990. In the past, cotton processors have used scouring agents containing toluene, xylene, perchloroethylene, and 1,1,1-trichloroethane (1,1,l-TCA) to remove waxes, oils, and grease from cotton fibers. They have successfully substituted nontoxic detergents and surfactants to achieve comparable results. Many companies have also trained their employees to use spotting solvents, such as perchloroethylene or 1,1,1-TCA sparingly. One company virtually eliminated its use of 1,1,1-TCA when it replaced its weaving looms with newer models. The newer equipment did not deposit as many grease stains on the yarn, thus reducing the need to use solvent for stain removal.

In the past, synthetic dyeing required use of solvents to act as dye carriers to take the dye into the fiber. Now many facilities employ pressurized dyeing equipment that eliminates the need for these solvents. Additionally, some facilities have substituted other safer chemicals for these solvents. A few facilities have abolished some processes involving TRI chemicals, one being a flame-retardant finish that contains the antimony compound. Another company substituted water-based compounds for solvent-based compounds in a Scotchguard process. Some companies no longer report as a result of EPA's decision in 1989 to delist sodium sulfate and sodium hydroxide.

Although releases of TRI chemicals for the coatings industry seemed to remain steady from 1987 through 1990, some of the facilities have implemented changes in their operations. A few of the coatings facilities have installed distillation units for onsite recycling of solvents. This has maintained or reduced the amount of offsite transfers of TRI chemicals depending on increased or decreased sales volume. Two facilities that have increased their production of UV-curable and/or water-based coatings and decreased production of solvent-based coatings reported a decrease in their solvent emissions. Another facility has decreased its solvent releases by adding tank rinsings to the next batch of a compatible product.

The furniture industry's use of chemicals depends on customer demands. Many of the industry's customers prefer the quality of wood furniture that has been finished with solvent-based products. However, the use of water-based finishes and high-solids coatings is becoming more common as a replacement for some, but not all, solvent-based finishes. Many companies have installed high-volume, low-pressure spray guns to reduce their solvent emissions. One facility has implemented a program to educate its spray gun operators on correct spraying techniques. This resulted in an increase in efficiency as well as a decrease in solvent releases.

Regardless of industry type, the majority of the companies surveyed have worked with their chemical suppliers to substitute nonTRI chemicals for TRI chemicals. For the most part, this communication has proved successful in either eliminating TRI chemicals in some products or at least reducing the percentage of TRI chemicals in the product, causing some companies to fall below threshold levels for reporting.

4.1.8 Other Responses

Each participant was asked if its facility needed assistance from the OWR for implementing waste reduction techniques. Some had received help in this area from OWR previously, but the majority were interested in obtaining additional information on pollution prevention. Those contacts expressing interest were given the telephone number of the PPP at the OWR.

When asked if the facility would participate in a confidential site visit, most responses were positive. Table VIII summarizes the overall responses obtained to these questions.

TABLE VIII
RESPONSES TO OTHER QUESTIONS

TOPIC	YES	NO
OWR Assistance	87	59
Site Visit Request	110	36

4.1.9 Possible Errors

Information from the WRMS data base helped to identify certain general errors. For example, if data were not present for a specific reporting year, contacts were asked if their facilities had submitted TRI reports for that year. Some indicated that they were probably below reporting thresholds for that year while others stated that they were not aware of TRI reporting procedures in its first year, 1987, and, therefore, did not report for that year. Others claimed, that because they did not receive the forms some years, they did not report. Some facilities had sent their reports to the State offices only and not to the Federal EPA office. These facilities were therefore not included in the WRMS data base since it is derived from EPA's records.

The WRMS data base was also effective in identifying media-specific reporting errors. As an example, approximately 50 percent of the 93 furniture companies interviewed reported zero releases of chemicals in the fugitive emissions category. It can be assumed that, due to the high usage of volatile chemicals within the furniture industry, there will be fugitive emissions of certain chemicals. These releases may come from leaks in pumps, valves, or seals, or they may be losses due to equipment cleaning.

As another example, during the reporting years 1987 through 1990, some of the coatings and wood furniture industries reported offsite releases of chemicals. Because these facilities were not required to report quantities of chemicals sent offsite for purposes of recycle or reuse, these values were over-reported and these reports were assumed to be in error. During the telephone interviews, facility contacts were questioned concerning their method of disposal of solvents during those four years. Their responses revealed that approximately 20 percent of the furniture companies interviewed should not have reported offsite transfers because solvents were sent offsite to be either recycled or fuel-blended.

4.1.10 Respondent Comments

Each respondent was asked to comment on the reporting requirements and overall TRI data quality. While some respondents stated that the entire reporting procedure is time-consuming, cumbersome, and frustrating, others feel that the procedures are sufficient and necessary. Some respondents feel their data submissions are fairly accurate; however, others voiced the concern that too much emphasis on estimation leads to poor data quality.

Facilities expressed their desire to see EPA or State agencies provide more intensive training seminars on how to correctly complete the reports. They stated that the pollution prevention section added in 1991 is especially difficult to complete and that training in this area would be beneficial.

Of those contacted, some smaller facilities feel that they are unfairly burdened with the reporting requirements. One contact stated that small businesses do not have the manpower and technical expertise to compete with larger firms. Some coatings manufacturers aid their customers with TRI reporting and state that many of them find reporting to be frustrating.

A few of the respondents suggested that the repetitive cover pages that are completed for each reportable chemical be eliminated. They would like to see adopted a cover page similar to that of EPA's Hazardous Wastes Annual Report.

4.2 Site Visit Results

At the site visits, a more thorough discussion of the processes and the calculation methodologies used to complete the TRI report was instrumental in identifying specific errors. In this section, the errors found in each release category (i.e., fugitive, stack, water, land, POTW, and offsite) are summarized for each of the three industries. Section 4.2.7 describes miscellaneous errors encountered during the site visits. Overall, it can be said that the information gathered during the site visits was more beneficial in identifying errors than the general information obtained during the telephone interviews.

A total of 25 site visits were conducted. Of the 10 textile finishing facilities visited, 8 had made some type of error on the TRI reports. Five coatings manufacturing facilities were selected to be visited and each had made errors in completing their reports. Of the 10 furniture manufacturing facilities, 7 showed flaws in reporting. A summary of the errors identified is presented in Section 4.2.8.

4.2.1 Fugitive Release Errors

Three textile finishing facilities made errors under this release category. All had not fully considered the evaporation of dye carriers from pits or lagoons that were part of each facility's wastewater treatment system. At one facility, wastewater from the dyeing operations containing volatile dye carriers is routed to an open equalization pit. After a holding period, the wastewater is discharged to the POTW. Therefore, all of the solvents in the wastewater were reported as being discharged to the POTW. A similar error occurred at another facility, which routed its wastewater to a mechanically aerated flow equalization lagoon. The third facility, which treated its wastewater in a mechanically aerated activated sludge basin, assumed a biodegradation of the solvents as a result of the activated sludge process. Various equations to calculate fugitive losses from such a basin will determine if this assumption is sound or whether the facility should report fugitive emissions.

Four of the five coatings manufacturers visited showed some inconsistencies in their reporting of fugitive emissions. One facility had not considered the reporting of fugitive emissions at all. Hence, it was calculated that between approximately 10,000 and 20,000 lb of solvents were under-reported for each of the four reporting years. One facility representative reports 1.5 percent of each chemical's usage as fugitive emissions but he does not believe that factor accounts for emissions from pipes, valves, and fittings. Another facility could be understating fugitive emissions by a factor of 16 because, in calculating its data, one air change per day is assumed instead of a more realistic two air changes per hour. The batch areas at another facility had a vacuum ventilation system, therefore, the contact assumed losses to the stack. However, during the site visit, it did not appear that the system was capable of removing all the vapors from the process to the stack. Therefore, fugitive emissions need to be considered from these areas.

Four of the 10 wood manufacturers visited made errors under this release category by not reporting any fugitive emissions. During the site visits, it was apparent that fugitive emissions can occur from leaks in pumps, valves, and fittings.

The remaining furniture facilities visited used engineering judgment to estimate their fugitive and stack emissions of chemicals. A range of 1 to 20 percent of the total amount of chemical used is reported as fugitive emissions and the remaining (80 to 99 percent) is reported as stack emissions. To accurately determine these releases, it was suggested that each facility use emission factors to calculate losses of the chemicals from pumps, valves, and seals. These emission factors are found in an EPA document, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form*. Each facility can then compare this figure to its amount allocated for fugitive emissions to determine if the percentage used is reasonable. If not, the ratio may be adjusted to improve the quality of their data. The remaining quantity can be assumed to be stack releases from spraying booths, drying ovens, and storage tanks. This is based on the assumption that the finishing area is enclosed and does not have a ventilation system other than the exhaust fans in the stacks connected to the booths and ovens.

4.2.2 Stack Release Errors

Of the textile finishing facilities visited, two had made errors in estimating stack releases. One facility had neglected to consider breathing and working losses from storage tanks. One tank stored perchloroethylene, a dry-cleaning solvent that is very volatile. The other tank contained hazardous waste still bottoms from the distillation of the perchloroethylene.

At the other facility, stack releases of sulfuric acid were reported. The facility burns coal as boiler fuel and sulfur dioxide is a byproduct of the combustion process. The facility contact explained that sulfuric acid is formed when the sulfur dioxide reacts with water vapor in the atmosphere. It was determined from an EPA publication, *Toxic Chemical Release Inventory Questions and Answers* (EPA-560/4-91-003), that facilities are not responsible for reporting a chemical resulting from a conversion in the environment. Therefore, it seems that the release need not have been reported.

One of the five coatings facilities visited had not considered stack releases from its bulk storage tanks. Another facility had not reported stack emissions from its ducted ventilation system.

Although no errors in estimating stack emissions were identified at the wood furniture manufacturing facilities that were visited, the potential for errors in this release category does exist. As mentioned in the previous subsection, the furniture facilities visited use engineering judgment to estimate their fugitive and stack releases. Although the facilities correctly report the total amount of chemical being released to the air, it is possible that there may not be an accurate distribution of the release between the fugitive and stack release categories.

4.2.3 Water Release Errors

Of the 10 facilities, only one textile finishing facility made an error in this category. In 1987, the facility incorrectly reported discharges to streams or waterbodies. The facility does not have an NPDES permit, therefore, the releases should have been reported to the POTW.

Similiarly, one of the furniture facilities reported a chemical discharge to a receiving stream. The company's NPDES permit had been rescinded the previous year, therefore, the amount discharged to water was erroneously reported.

No water releases of TRI chemicals were reported for the facilities visited in the coatings manufacturing industry.

4.2.4 Land Release Errors

Two furniture manufacturing facilities reported a chemical release to the land for the 1988 reporting year. In each case, the form preparer had reported the amounts of the chemicals sent offsite as land releases as well as offsite releases. This caused an overreporting of 14,000 and 30,000 lb of solvents at the two facilities.

There were no land release errors identified for the facilities visited in the textile finishing and coatings manufacturing industries.

4.2.5 POTW Release Errors

Three of the textile finishing facilities visited made errors in reporting releases to the POTW. One facility, which used the solvent 1,1,1-TCA for cleaning purposes, reported a 45,600-lb release to the POTW. Because the solvent was used to remove stains from fabric during the inspection process and it evaporates almost immediately, this amount should have been reported as a fugitive emission.

At another facility, an error was found in the reporting of sulfuric acid and sodium hydroxide. The facility representative stated that sulfuric acid was used to neutralize caustic wastewater to a pH of 6 to 9. If this is the case, then release quantities of zero should have been reported. Hence, an over-reporting was noted of 50,000 lb, 50,000 lb and 200,000 lb of sulfuric acid for the 1987, 1988, and 1989 reporting years, respectively. Similarly, because sodium hydroxide was neutralized prior to discharge to the POTW, release quantities of zero should have been reported. Therefore, the facility over-reported 167,000 lb of sodium hydroxide in each of the reporting years of 1987 and 1988.

A third facility also used sulfuric acid for neutralization purposes. More than 10,000 lb of the chemical were used; however, a report was not filed. Although sulfuric acid was effectively consumed during the neutralization process and no releases resulted, EPA requires that a report be submitted showing zero releases.

No TRI chemicals were reported as being discharged to the POTW for the facilities visited in the coatings and wood furniture manufacturing industries.

4.2.6 Offsite Release Errors

Three of the wood furniture facilities showed errors in reporting their offsite releases of TRI chemicals. It was found that during the years 1987 through 1990, each of the three facilities sent their solvents to an offsite facility for reuse or recycling and reported those amounts as offsite releases. During those years, amounts of chemicals that were being recycled or reused offsite were not required to be reported.

There were no offsite release errors identified for the textile finishing and coatings facilities that were visited.

4.2.7 Other Errors

One textile finishing facility, it seemed, did not submit a report for the 1988 reporting year. Its large use of a TRI chemical, perchloroethylene, indicates that a report should have been submitted for that year. At a different textile facility, it was found that the facility discarded newer MSDSs that were received with their chemical shipments if an MSDS for the same product was already on file at the facility. Therefore, to determine TRI chemical content in a product, the contact uses older MSDSs that may have since been revised. Because MSDSs have become more detailed and specific in recent years, the facility may omit reporting certain chemicals.

Other errors were encountered at three of the coatings facilities. At one facility, it was not clear whether TRI forms had been submitted for the 1989 and 1990 reporting years. The same facility found it difficult to differentiate between the "manufacture or process" and "otherwise use" definitions in 1987 and 1988. In 1988, emissions of glycol ethers were not reported at this facility.

At a different coatings facility, emissions from two chemicals that were used above threshold levels were not reported for the 1989 reporting year. Additionally, because reporting forms were not received for the 1990 report, the facility made no submission.

Another facility uses monitoring data that are gathered every other year to help estimate its emissions. Instead of correcting the data for production changes in the off years, the facility reuses the data until new data are taken. For the 1987 through 1990 reporting years, this facility did not report emissions of ethylene glycol used above the 25,000-lb threshold. At the site visit, it was evident that the potential existed for unreported fugitive and stack emissions as well as POTW releases.

Three of the furniture facilities visited reported releases of isopropyl alcohol, which was a constituent of the finishes they used. This chemical is required to be reported only if it is manufactured by the strong acid process. Because the chemical was otherwise used at the three facilities, it should not have been reported.

Four facilities neglected to report emissions of TRI chemicals that were used above the 10,000-lb reporting threshold. With the exception of one facility, these errors occurred because the 1987 reports were completed by inexperienced form preparers. The other facility did not report the release of glycol ethers on the 1990 report.

4.2.8 Summary of Errors

The following list summarizes the general types of errors identified during the 25 site visits for the data submitted during the 1987 through 1990 reporting years. They include:

- not submitting a report package for a specific year;
- submitting a report package to the EPA office but not the State agency or vice versa;
- not submitting reports for chemicals used above reporting thresholds;
- reporting releases of chemicals to the wrong media;
- neglecting to consider fugitive releases from wastewater treatment areas;
- neglecting to consider stack releases from chemical storage tanks;
- neglecting to consider fugitive losses from equipment leaks;
- reporting releases of chemicals sent offsite to be recycled or reused;
- reporting amounts of chemicals that have effectively been neutralized prior to discharge;
- reporting releases of chemicals that do not need to be reported, specifically those chemicals listed with a qualifier; and
- over-reporting or under-reporting of certain chemicals resulting from a misunderstanding of the definitions of "manufactured or processed" chemicals and "otherwise used" chemicals.

The site visits proved to be more useful than the telephone interviews in identifying reporting errors. Each telephone interview took an average of one-half hour and each site visit took an average of about four hours. This additional amount of time enabled us to conduct a thorough tour of the plant and examine TRI documents. As a result, possible sources of releases were easily identified. The TRI reports and supporting calculations helped to ascertain if the chemical release estimates were computed in a reasonable manner. Chemical purchase information was also examined, which resulted in an identification of chemicals that were purchased in quantities above threshold levels but were not reported. These factors enabled us to calculate specific amounts of chemicals that were over-reported or under-reported. These results and other errors identified are presented for each facility in the site visit reports contained in Appendix E.

Additionally, during the site visits, the contacts were more helpful in answering detailed questions as they arose during the course of the visit. Respondents participating in the telephone interviews generally gave brief answers to the questions, which made identification of possible reporting errors not as feasible. The site visits also provided a chance to suggest to facility representatives ways to improve their data. If applicable, EPA publications on how to accurately estimate chemical releases were shown to the facility representatives.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study suggest that many errors exist in the data submitted for the 1987 through 1990 reporting years for the three industries studied. A variety of factors contributed to the errors including:

- In 1987, when the TRI reporting procedures were introduced, some facilities were not aware they were required to submit reports. Therefore, a fair number of facilities did not report for the 1987 calendar year although they met the reporting requirements.

- Data at some facilities were not very accurate because different people were responsible for completing the forms each year. Each person's different interpretation of the instructions affected data quality. Therefore, assuming a thorough understanding of the regulations and guidelines, it would seem that continuity of the form preparer within the facility would lead to better data quality.

- Data quality was affected when facilities employed members of their nontechnical staff to complete Form R. It was found that form preparers with a technical background and a thorough understanding of the facility processes were more equipped to correctly complete Form R.

- The smaller facilities showed more inconsistent reporting than their larger counterparts. Possible reasons for this finding include that they probably do not have the resources to accurately estimate emissions and smaller businesses may not have the time or personnel to effectively deal with environmental regulations.

- A majority of facilities made errors that could have been avoided if they had taken advantage of various EPA publications that are available to aid in TRI reporting. The EPA publication, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form,* is especially helpful for identifying possible sources of releases and how to calculate them. Additionally, the furniture and coatings industries can benefit from obtaining the EPA guidance document, *Estimating Chemical Releases from Spray Application of Organic Coatings.* The guidance document, *Estimating Chemical Releases from Textile Dyeing*, is also available to aid the textile industry in reporting releases. AP-42 is another valuable document published by the EPA that all facilities can use to accurately estimate their air releases by using emission factors. It also presents possible sources of releases that form preparers may not be targeting for reporting.

It can be said, however, that the 1989 and 1990 release data show significant improvements over the previous reporting years. This is due to a number of factors:

- Since 1989, MSDSs have become more detailed. Suppliers not only list all the TRI chemicals present in their product but they have become more concise in specifying the percentage of the chemicals present.

- As a result of complying with other environmental regulations, industry has installed monitoring devices to accurately measure their releases. For example, monitors on stacks enable facilities to determine types and quantities of TRI chemicals being released to the atmosphere. Those facilities with POTW or NPDES permits are required to analyze their wastewater before discharge. The analyses can result in a more accurate determination of chemical releases to the water.

- Facility representatives are becoming more knowledgeable about reporting requirements. This results from increased attendance at TRI seminars sponsored by the EPA, State agencies, or trade associations. It also may result from increased corporate involvement in the facility's reporting procedures. Facilities with corporate departments usually have the resources and funding to educate their employees on environmental issues.

As the EPA funds more environmental projects, it is possible that more information will be available to help facilities calculate their releases. To illustrate, in the latter part of 1990, an EPA document, *Toxic Air Pollutant Emission Factors*, was published that introduced emission factors for chemicals released during specific processes. Additionally, revisions and additions are made periodically to AP-42 to reflect newly gathered information. As an example, in October 1992, Section 1.6 describing wood waste combustion in boilers was updated to include emission factors for pollutants that are released from the burning of wood. Some of these pollutants are TRI chemicals whose emission factors are high enough to trigger reporting thresholds for those furniture facilities that burn scrap wood in large quantities. For example, formaldehyde and manganese are two chemicals that are coincidentally manufactured when wood is burned. Their corresponding emission factors are 0.48 and 1.0 lb per ton of wood burned. Consequently, those facilities burning more than 25,000 tons of wood annually would have to report stack releases of manganese and determine if releases of formaldehyde should also be reported.

A number of recommendations can be made to improve the quality of the TRI data that are being reported.

- EPA should adopt the 1991 TRI Reporting Form R as its final edition for future reporting years. Data quality is affected when major changes to the forms are introduced. The reporting burden to industry increases as they struggle to familiarize themselves with new sections of the form.

- Industry-specific seminars for guidance on reporting should be introduced. A representative who is familiar with a specific industry's processes could address a group of people within that industry. In this way, certain reporting issues relevant to that industry would not likely be omitted. Question and answer periods would be relevant for all present. Trade organizations may want to cooperate with EPA in this undertaking.

- EPA should offer more Technical Guidance Documents in addition to the 14 that are available at this time. Specifically, one topic could be the TRI chemicals that are released from combustion in boilers. Few companies have addressed this activity as a possible source of release.

- Many of those contacted would like to see a standard format introduced for MSDSs. They feel that some suppliers are vague in presenting their product information on the MSDSs and that this ultimately affects the quality of the facility's data.

- Those industries required to file TRI forms are recommended to obtain the publications mentioned here to aid them in accurately calculating their releases.

- Further efforts are needed to identify and educate the facilities that should be reporting but are not. Those facilities not reporting may significantly impact the overall TRI emission quantities and, in turn, environmental policy decisions such as the determination of attainment and nonattainment areas.

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APPENDIX A

SAMPLE WRMS DATA SHEET

FACILITY DRZX000099 FACILITY NAME
[redacted]
361 BLUE RIDGE ST.

MARION, NC 28752 (MC DOWELL COUNTY)
CONTACT: [redacted], 704/[redacted]

SICs: 2511

EPA ID: AIRS ID:
NPDES ID: TRI ID:

STATUS AND EMISSIONS DATA FOR 1987

RECEIVING WATERBODY:
POTW: MARION CORPENING CREEK WWTP

CHEMICAL/WASTE	FUGITIVE	STACK	WATER	LAND	POTW	OFF SITE	ON SITE
BIS (2-ETHYLHEXYL) PHTHALATE	349	11,297	0	0	0	0	0
METHANOL	3,372	109,014	0	0	0	0	0
ACETONE	341	11,020	0	0	0	0	0
XYLENE	915	29,598	0	0	0	0	0
TOLUENE	1,756	56,777	0	0	0	0	0
METHYL ETHYL KETONE (MEK)	369	11,930	0	0	0	0	0
n-BUTYL ALCOHOL	1,209	39,102	0	0	0	0	0
PARTICULATES	0	20,000	0	0	0	0	0
SULFUR DIOXIDE (SO2)	0	66,000	0	0	0	0	0
NITROGEN DIOXIDE (NO2)	0	20,000	0	0	0	0	0
VOLATILE ORGANIC COMPOUNDS (VOC)	0	834,000	0	0	0	0	0
CARBON MONOXIDE (CO)	0	18,000	0	0	0	0	0
BOD 5	0	0	0	0	25,108	0	0
TOTAL	8,311	1,226,738	0	0	25,108	0	0

STATUS AND EMISSIONS DATA FOR 1988

RECEIVING WATERBODY:
POTW: MARION CORPENING CREEK WWTP

CHEMICAL/WASTE	FUGITIVE	STACK	WATER	LAND	POTW	OFF SITE	ON SITE
n-BUTYL ALCOHOL	1,521	49,173	0	0	0	0	0
ACETONE	488	15,793	0	0	0	0	0
METHANOL	3,738	120,856	0	0	0	0	0
XYLENE	845	27,308	0	0	0	0	0
TOLUENE	2,165	69,999	0	0	0	0	0
METHYL ETHYL KETONE (MEK)	569	18,387	0	0	0	0	0
PARTICULATES	0	30,000	0	0	0	0	0
SULFUR DIOXIDE (SO2)	0	62,000	0	0	0	0	0
NITROGEN DIOXIDE (NO2)	0	18,000	0	0	0	0	0
VOLATILE ORGANIC COMPOUNDS (VOC)	0	828,000	0	0	0	0	0
CARBON MONOXIDE (CO)	0	14,000	0	0	0	0	0
F005FLAMM SOLVENT	0	0	0	0	0	56,000	0
D001FLAMM LACQUER	0	0	0	0	0	1,400	29,200
D001WST PETROL	0	0	0	0	0	1,010	0
BOD 5	0	0	0	0	30	0	0
TOTAL	9,326	1,253,516	0	0	30	58,410	29,200

STATUS AND EMISSIONS DATA FOR 1989

RECEIVING WATERBODY:
POTW: MARION CORPENING CREEK WWTP

CHEMICAL/WASTE	FUGITIVE	STACK	WATER	LAND	POTW	OFF SITE	ON SITE
METHANOL	3,247	104,981	0	0	0	0	0
ACETONE	495	16,016	0	0	0	0	0
n-BUTYL ALCOHOL	1,717	55,510	0	0	0	0	0
METHYL ETHYL KETONE (MEK)	687	22,226	0	0	0	0	0
TOLUENE	2,104	68,025	0	0	0	0	0
XYLENE	916	29,607	0	0	0	0	0
FORMALDEHYDE	493	15,951	0	0	0	0	0
PARTICULATES	0	30,000	0	0	0	0	0
SULFUR DIOXIDE (SO2)	0	94,000	0	0	0	0	0
NITROGEN DIOXIDE (NO2)	0	18,000	0	0	0	0	0
VOLATILE ORGANIC COMPOUNDS (VOC)	0	828,000	0	0	0	0	0
CARBON MONOXIDE (CO)	0	14,000	0	0	0	0	0
D001SOLID RESINS, POLYMERIZED ORGANICS FROM PHYS. SCRAPING & REM	0	0	0	0	0	0	121,800
F003F005 PAINT THINNER, PETROLEUM DISTILLATE FROM STRIPPING	0	0	0	0	0	67,200	0
D001PAINT THINNER, PETROLEUM DISTILLATE FROM OTHER CLEANING/DEGR	0	0	0	0	0	1,060	0
BOD 5	0	0	0	0	55	0	0
TOTAL	9,659	1,296,316	0	0	55	68,260	121,800

STATUS AND EMISSIONS DATA FOR 1990

RECEIVING WATERBODY:
POTW: MARION CORPENING CREEK WWTP

CHEMICAL/WASTE	FUGITIVE	STACK	WATER	LAND	POTW	OFF SITE	ON SITE
D001SOLID RESINS, POLYMERIZED ORGANICS FROM PHYS. SCRAPING & REM	0	0	0	0	0	0	51,300
F003F005 PAINT THINNER, PETROLEUM DISTILLATE FROM STRIPPING	0	0	0	0	0	86,800	0
D001PAINT THINNER, PETROLEUM DISTILLATE FROM OTHER CLEANING/DEGR	0	0	0	0	0	1,170	0
METHANOL	2,172	70,231	0	0	0	0	0
ACETONE	475	15,374	0	0	0	0	0
n-BUTYL ALCOHOL	1,218	39,394	0	0	0	0	0
TOLUENE	1,490	48,193	0	0	0	0	0
XYLENE	719	23,258	0	0	0	0	0
BOD 5	0	0	0	0	15	0	0
TOTAL	6,074	196,450	0	0	15	87,970	51,300

APPENDIX B

COVER LETTER REQUESTING PARTICIPATION IN TELEPHONE INTERVIEW

January 1993

Dear :

The North Carolina Division of Emergency Management, in cooperation with the North Carolina Office of Waste Reduction, is conducting a Toxic Chemical Release Inventory (TRI) Data Verification Project. The objectives of this project are to use the TRI data for tracking waste generation and waste reduction efforts. Verification of the TRI data will allow the State to confidently use the TRI data as accurate information for environmental planning and policy decisions.

We hope that you will participate in a voluntary telephone survey of facilities that submitted Form R reports in years 1987 to 1990 for the TRI under Section 313 of SARA Title III. Based on survey results, we can offer technical assistance and information in areas such as Form R completion, calculation of release estimates, and methods of waste reduction. Research Triangle Institute is conducting this survey and may be contacting you in the near future.

Participation in this telephone survey is voluntary; however, we believe that participation in the survey will assist you in determining compliance with reporting requirements, estimating chemical releases, and improving overall data quality. **Confidentiality and anonymity will be assured.**

The survey will address the following:

- concerns about unclear sections of Form R;
- problems related to chemical threshold determinations;
- difficulties in calculating release estimates;
- methods of documenting chemical usages, emissions, and waste generation; and
- recommendations to simplify Form R reporting.

Thank you for your cooperation. If you have any questions about this project, please contact Ronald Pridgeon of the North Carolina Office of Waste Reduction at (919) 571-4100.

Sincerely,

Joseph F. Myers
Chairman

APPENDIX C

TELEPHONE INTERVIEW QUESTIONS

Date: ____________
First Contact: ____________
Second Contact: ____________
Third Contact: ____________
Length of Call: ____________

TRI PHONE CALL QUESTIONNAIRE

Company Code:
Number of employees:
Number of shifts:
Concerns/Questions from Review of TRI Data:

1) What is the job title of the TRI form preparer and what are his other job functions?

2) Did the preparer receive any training or outside assistance in completing the TRI report and did it help at all?

3) List any software and/or publications that were used for assistance with TRI reporting?

4) How many man-hours were required to complete the TRI report?

5) How are the TRI records or documentation maintained (e.g., computer system, one central file or many various locations)?

Company Code: ____________
Date: ____________

6) List the specific sections of the form that the preparer had difficulty completing. Why?

7) Does the facility have any internal use for the TRI data (e.g., to identify waste reduction trends, to target pollutants for waste reduction, etc.)? Explain.

8) Briefly describe the main operations at this company and identify its main sources of TRI emissions.

9) Did the facility's processing operations change significantly or did the facility implement any new control technology during the years 1987-90? How have these changes impacted TRI estimates?

Company Code: ____________
Date: ____________

10) What methods are used to calculated chemical release estimates?
(Actual measurements (M), emission factors (E), mass balances (C) or engineering judgements (O)).

Fugitive Releases:

Stack Releases:

Water Releases:

Land Releases:

POTW Releases:

Off-Site releases:

11) Comments on questions asked from review of the TRI data obtained from WRMS .

12) Inquire about any concerns or needs for assistance in waste reduction. Would the company like assistance from the Office of Waste Reduction for minimizing waste?

13) If the facility was randomly selected for a confidential site visit to gather additional information, would they be willing to participate?

14) Are there any overall questions, concerns or comments about TRI reporting requirements and data quality (e.g., interest in a training seminar)?

APPENDIX D

SAMPLE SITE VISIT REQUEST LETTER

April 12, 1993

Mr. John Brown
Furniture Makers
16 City Drive
Winston-Salem, NC 27107

Dear Mr. Brown:

As we discussed on Monday, April 12, 1993, the Office of Waste Reduction of the State of North Carolina and Research Triangle Institute (RTI) are conducting a study on the accuracy of data that is reported on the Toxic Release Inventory (TRI) form (Form R). One of the industries we have been focusing on has been the furniture manufacturing industry. The first part of this project consisted of a telephone survey in which you participated. The second part of this project involves visiting randomly selected facilities. We believe the site visit will aid facilities in complying with TRI reporting requirements and estimating TRI chemical releases. Additionally, it will assist RTI and the State of North Carolina in determining the accuracy of TRI data reported during the years 1987 through 1990.

For these reasons, we have requested that you arrange a tour of your plant on Friday, April 23, 1993. The purpose of the visit is not regulatory in nature; it is for information gathering. However, confidentiality and anonymity will be assured.

Enclosed you will find an agenda that we wish to follow during the site visit. I hope you will agree to this visit as the information obtained will greatly assist us in our project. If you have any questions, please do not hesitate to contact me at (919) 541-5882.

Sincerely yours,

Marjan Najafi
Chemical Engineer
Pollution Prevention Program

MN/kmf
Enclosure

SITE VISIT AGENDA

I. PROJECT EXPLANATION

- Discussion of Objectives and Goals of the Project
- Significance of Site Visit

II. PROCESS OVERVIEW

- Discussion of Facility Processes and Operating Procedures
- Process Flow Diagram

III. PLANT TOUR

IV. REVIEW OF FORM R AND SUPPORTING DOCUMENTATION FOR 1987 THROUGH 1990

- Material Safety Data Sheets
- Chemical Usage Information
- Emission Estimation/Calculation Procedures

V. SITE VISIT SUMMARY

- Ensure confidentiality for information gathered during site visit.

- Discussion of TRI data--questions, comments, concerns, etc.

- Discussion of services offered by the Pollution Prevention Pays Program at the Office of Waste Reduction, State of North Carolina.

APPENDIX E

SITE VISIT REPORTS

BACKGROUND AND PROCESS INFORMATION

This small printing facility is wholly owned by another company called a "converter" who supplies the designs, colors, and fabrics to be used. The final products are fabrics intended for children's sleepwear and women's loungewear. The fabrics are mainly rayon, cotton, polyester, or blends of these. At this time, the plant operates 12-hour shifts, 4 days per week with their fabric output ranging from 230,000 to 313,000 yards per week.

Knit goods enter the plant already prepared for printing. Woven goods are in the greige state and need to be bleached. The fabric first is soaked in a steaming caustic solution to remove contaminants. After a series of hot washes, the fabric is soaked in a peroxide solution to bleach the fabric. After a hot wash, then a cold wash, the fabric is rolled and is finally ready for printing.

The printing process is an aqueous pigment print system that is used successfully on the natural fibers, as well as the synthetic fibers. The facility has three roller printers and one rotary screen printer which was purchased in the past 12 months. The rollers and screens imprinted with the designs are made at another facility. After printing, the textiles go through various finishing processes. Softener is applied to the woven goods and the knit goods are stretched on a tenter frame. Embossing of fabric is sometimes done to produce textured fabric. Finally, all fabric goes through an inspection process to identify defects.

TRI CHEMICAL USAGE

In 1987 and 1988, sodium hydroxide and sulfuric acid were reported. In 1989 sodium hydroxide was delisted. Sulfuric acid was the only TRI chemical reported for the 1989 and 1990 reporting years. It is used to neutralize caustic wastewater before discharge to a POTW. Some of the dyes contained ammonia and ethylene glycol; however, after reviewing MSDSs and purchasing information, it was found the total amounts were below reporting levels.

COMMENTS

The form preparer was not aware that sodium sulfate should have been considered for reporting in the 1987 reporting year. Sodium sulfate was manufactured as a result of sulfuric acid neutralizing the caustic solution. Using formulas developed by the EPA in *Title III Section 313 Release Reporting Guidance--Estimating Chemical Releases From Textile Dyeing* and the usage amount of 50,000 lb of sulfuric acid, it was calculated that 72,449 lb of sodium sulfate was manufactured. The reporting requirement for manufactured chemicals was 75,000 lb in 1987, therefore, the facility was below reporting thresholds for this chemical in 1987. Sodium sulfate was delisted in 1988.

A possible error was found in the reporting of sulfuric acid in 1987, 1988, and 1989. Because sulfuric acid is used to neutralize wastewater to pH 6 to 9, release quantities of zero should have been reported. Hence, an over-reporting was noted of 50,000 lb, 50,000 lb, and

200,000 lb of sulfuric acid for the 1987 through 1989 reporting years, respectively. Similarly, because sodium hydroxide was neutralized prior to discharge to POTW, release quantities of zero should have been reported. Therefore, an over-reporting was noted of 167,000 lb of sodium hydroxide in each of the reporting years of 1987 and 1988.

The facility stated that as new MSDSs were sent by the suppliers, the facility would discard these new MSDSs if an old one was already present for that chemical. Therefore, the facility had MSDSs dating back to 1985 on file. Because many suppliers improved their information on MSDSs in 1989, it was suggested that the facility keep new MSDSs as they came in and to discard the old ones.

BACKGROUND AND PROCESS INFORMATION

This large, fully automated facility finishes approximately 1.2 million yards of fabric per week. Their main processes are piece-dyeing and finishing of woven fabrics, specifically upholstery and drapery fabric and mattress ticking. The fabric enters the plant in woven form and is sorted by style and process to be performed. For example, some fabric may be dyed and finished, other fabric finished only.

The majority of the mattress ticking entering the facility is coated with an acrylic latex or a fire-retardant acrylic latex. However, some mattress ticking may be heatset, then scoured in a jet and dyed. After drying, the ticking continues to a calendering process line where a slick and shiny surface is imparted onto the fabric.

Upholstery and drapery fabric are dyed in pressurized or atmospheric jets. Direct and disperse dyes are used. After dyeing, the fabrics are dried and sent to the finishing lines.

Some upholstery fabric may be coated with an acrylic latex, Scotchguard, and/or a fire-retardant coating. Other upholstery fabric may proceed to a printing process. The facility uses a technology called heat-transfer printing. The print design is on a tissue-like paper that is placed on the face of the fabric. Then, both layers are dried on heated cylinders. The heat transfers the dyes from the tissue paper onto the upholstery fabric. Waste tissue paper is shipped offsite as solid waste.

Most drapery fabric is finished with a resin or a handbuilder. However, a small quantity of drapery fabric may be needle punched to a nonwoven substrate. This process uses a machine that has approximately 30,000 needles that affix the backing material to the fabric. The finished material is sent to another facility where it is slit for use as vertical blinds.

All fabric is ultimately brought to the inspection department. If a portion of the fabric is soiled, 1,1,1-TCA is used to clean the area. The fabric is then wrapped in plastic and shipped.

TRI CHEMICAL USAGE

The latex foam formulations used for coating the fabric contain ammonia. In 1989, latex foam began to be used to impart a fire-retardant finish onto upholstery and ticking fabrics. These fire-retardant foams contain antimony and decabromodiphenyl oxide. They are considered process chemicals and because the facility used greater than 25,000 lb in 1990, they were reported for that year.

During the site visit, a drum marked ammonium sulfate was seen. The facility representative stated that it is used as an aid in dyeing nylon. Because nylon is rarely dyed here, that drum has lasted for a couple of years and, therefore, the facility falls below the threshold level for reporting. The quantity of ethylene glycol, a component in the

Scotchguard formula, used at the facility is also below reporting thresholds. Maintenance chemicals are also considered for TRI chemical content, but are below reporting levels.

In 1987 and 1988, 1,1,1-TCA was a constituent of a scouring solution and was reported. Reporting years 1989 and 1990 show no usage of this solvent because the scouring process was transferred to a sister plant. The solvent 1,1,1-TCA is also used as a spotting agent. Approximately 6,600 lb of this solvent are used per year. About two 55-gallon drums per year of perchloroethylene are used in their dry-cleaning machines.

COMMENTS

Purchasing information and percentages from MSDSs are used by the facility to calculate the quantity of TRI chemical usage. For ammonia, the facility assumes 1 percent of the quantity used is being released to the POTW. This percentage is based on information from their manufacturing department. To determine the quantity of ammonia being released as stack emissions, air recirculation rates are used to calculate the amount of ammonia combusted in the direct-fired ovens. They assume that the majority of the antimony and deoabromodiphenyl oxide is retained on the fabric, and estimate that about 1.5 percent of the usage of these two chemicals is released to the POTW.

The facility strives to ease their reporting burden. They have worked with their suppliers in the past to substitute or eliminate toxic chemicals in the formulas they use. They have successfully removed acetone from their Scotchguard extender. A nonTRI chemical was substituted for decabromodiphenyl oxide in their fire-retardant foam that is used on upholstery fabric. Because pressurized jets are used to dye fabric, the use of solvent-containing dye carriers has not been necessary. Additionally, the heat transfer printing process eliminates wet printing processes that may utilize TRI chemicals.

The representative at the facility believes that gathering the information for the Form R encourages them to focus on waste reduction. He mentioned that he reports on magnetic media to the EPA and submits hard copies to the State agency. He would like to see the State accept reports electronically also.

BACKGROUND AND PROCESS INFORMATION

At this much larger than average facility, towel production begins by receiving bales of cotton. Polyester is seldom processed. In the greige mill, the cotton fibers are mechanically cleaned, aligned, and twisted to produce yarn. While some of the yarn is dyed on the beam, most is prepared for weaving in a process called slashing where a coating of polyvinyl alcohol, starch, and wax is applied. Beam-dyed yarn proceeds through slashing after it is dyed. Some of the fill yarns are package dyed. Dyed or undyed yarn is woven on looms. Undyed towels may be bleached and piece dyed or just bleached. Approximately one-fourth of the towels that are produced are undyed.

Wet finishing begins with preparation which includes a hot, aqueous wash to remove size and other contaminants. A scour in an aqueous solution of caustic soda, detergent, and phosphated alcohol follows. The goods are rinsed with hot water and then bleached with a hydrogen peroxide solution. Upon a final hot water rinse, preparation is complete.

The three dye systems that are used include vat, reactive, and naphthol dyes. Approximate usage rates are 50, 35, and 15 percent, respectively. When polyester fibers are incorporated into the towel, they are blended with cotton to produce yarn for the base warp. As a result, the yarn is masked and there is no need to dye these fibers. Whether continuous piece dyeing or batch package/beam dyeing is used, the first bath is an aqueous solution of dye. Depending on the dye system, chemicals such as caustic soda, brine, and sodium hydrosulfite are introduced in a second step. Heat, or steam, is used to "fix" the dyes onto the substrate. Hot, aqueous washes are used to remove residual, unfixed dye. When softeners are applied, buffers, such as citric acid or soda ash, are used to control the pH.

There is a 5,000-gallon bulk storage tank for storing sulfuric acid which is used to neutralize caustic wastewater before discharge to the POTW. Another storage tank is used to store a resin containing formaldehyde. Much of the electricity and all of the steam that the facility uses is generated in an onsite coal-fired boiler.

TRI CHEMICAL USAGE

The TRI chemicals released at this facility during the years 1987 through 1990 include hydrochloric acid, which is used to clean boiler tubes; ammonia, which is used in the wastewater treatment system; and sulfuric acid, which is released as a result of burning coal. The form preparer noted that because lower quality towels are manufactured here, fewer chemicals are needed and, therefore, fewer chemicals are released.

COMMENTS

For the 1987 through 1990 TRI reporting years, releases were estimated by manually adding contributions from the processing chemicals. The large size of the facility and number of products used made this task tedious. As a result, the individual responsible for compliance requested that a computer system be developed for assistance.

From reporting year 1991, calculations are prepared on a mainframe computer. Annual purchasing data are combined with the product constituent information from MSDSs to obtain chemical usage rates. An assumption about the reporting fate is made and the release is manually entered on the form. An elaborate system exists to ensure that only accurate and up-to-date information from the MSDSs is included. Emissions of sulfuric acid from the burning of coal as boiler fuel are based on AP-42 and IRIS emission factors. However, the sulfuric acid is formed when sulfur dioxide reacts with water vapor in the atmosphere. The facility is not responsible for reporting a chemical resulting from a conversion in the environment. Therefore, the facility's 1990 TRI data showed an over-reporting of 23,000 lb of sulfuric acid.

Only process chemicals are included in the computer system. Within a year, the facility hopes to centralize the purchasing of all products and include these in the system. Some nonprocess chemicals are not ordered through the central purchasing department. No effort is made, even manually, to include emissions from these products in the inventory. Fugitive releases from material storage and handling are not considered.

Because the individual responsible for compliance does not have a computer, submission on magnetic media has not been considered. The contact suggested that the government should require that MSDSs should be in a standard format. She believes that 1987 and 1988 TRI data probably are not as accurate as later years because MSDSs during those two years were not complete. Since 1989, however, she has seen a significant improvement in the MSDSs because the suppliers are striving to be as specific as they possibly can in listing chemical content.

Products are not selected on the basis of reducing TRI emissions. Sometimes the results of increasing efficiency are apparent from, but are not initiated by, TRI submissions. New processes have not been implemented to reduce emissions of TRI chemicals. The contact surmised that the suppliers have reformulated several products to reduce the quantity of listed chemicals. For example, propylene glycol has been substituted for ethylene glycol in one dyestuff. Another dyestuff that previously contained diethylamine has been reformulated without it.

BACKGROUND AND PROCESS INFORMATION

This smaller-than-average facility runs a 3-shift-per-day, 6-day-per-week operation to produce 450,000 to 500,000 lb of knit goods per week. Greige goods of polyester, cotton, some acrylic, a small amount of wool, and blends of these fibers are received for dyeing and finishing.

After being received, the fabric is "set made" by loading appropriate amounts into tubs. The goods are loaded into a jet dyeing machine where preparation commences with a peroxide and caustic bleach. Next, a detergent scour is used to remove waxes, oils, and other contamination of the fabric. After preparation, the fabric is dyed. Wastewater discharges to a flow equalization reservoir. This effluent is metered for POTW billing purposes.

Dye classifications that are used include the disperse, direct, reactive, basic, and acid systems. When polyester/cotton blends are dyed, disperse dye staining of the cotton is minimized by using carriers to improve the disperse dye exhaustion. Unlike other goods, 100 percent polyester fabric is scoured using equipment designed for continuous rope bleaching. After heat setting on a tenter frame, this product is then shipped to a printer.

Next, goods shipped as open width are slit. A softener or resin (for shrinkage control) may be applied to the fabric. It is then heat set on one of three tenter frames which are vented to stacks. Before being shipped, 95 percent of the product is inspected. For tubular goods, a softener or resin finish may be applied on a Tripad Extractor. A conveyor drier follows. Then, after calendering or compacting, the product is shipped.

In the past, the facility used tetrachloroethylene for spot cleaning at the inspection tables. Now, the company either downgrades soiled fabric, removes the soiled area, or rescours the fabric in the jet. The contact stated that radial migration of the soil which leaves a larger spot, "ringing," was a problem during spotting.

The facility has a laboratory for color matching, quality control evaluation, and flame-retardancy testing. A small maintenance department is onsite. For both departments, no products are used in amounts that would trigger TRI reporting.

TRI CHEMICAL USAGE

Most of the products used are purchased in drum quantities. To avoid product contamination and, in some cases, evaporation, lids are kept in place. Resins contain formaldehyde in the amount of 0.1 percent. This facility does not use enough of this material to meet the reporting limit. Alternative formulations without formaldehyde do not perform as well as the traditional products. Some customers request that formaldehyde-containing resins not be applied. They may specify that a compacting step be included instead. The contact stated that this process does not permanently impart shrinkage control, however. Specific dyes that are listed as TRI reportable chemicals are not used at the facility, and, according to this representative, they are rarely, if ever, used in the industry.

The only chemicals used in amounts subject to TRI reporting are carriers. These products contain 1,2,4-trichlorobenzene, pseudocumene (1,2,4-trimethylbenzene), and biphenyl. The company received guidance from a supplier on the reporting fate of carriers. According to the supplier, 96 percent is discharged in the wastewater stream. Accordingly, the company reported this emission to the POTW. The supplier stated that 3 percent would exhaust through the tenter frame stack. This was reported as a stack emission. The remaining amount, 1 percent, volatilizes during handling and was reported as a fugitive emission.

COMMENTS

Because the definitions for the different reporting thresholds are confusing to the facility spokesman, the smaller and more conservative "otherwise used" threshold of 10,000 lb is employed. For the chemicals that are reported, the 25,000-lb limit would be satisfied as well. Purchasing records are used to obtain the pounds used for the year. These are manually multiplied by the TRI constituent concentration that is included on MSDSs. To ensure the calculations are correct, a procedure is in place to review and distribute new and revised MSDSs. Additionally, the facility has a monthly meeting to review product hazards and reporting issues. If possible, new products will not be purchased if they contain TRI listed, or otherwise hazardous, chemicals.

Several products have been eliminated or reformulated to reduce the usage of reportable chemicals. Reasons given were environmental concerns, workplace safety, and community relations. The contact stated that zero emissions of reportable chemicals through product substitution is a facility goal. For example, until 1990, perchloroethylene was a component of scouring agents. After a local newspaper article listed the plant and its emissions, the use of this product was discontinued.

In 1987, the facility incorrectly reported discharges to streams or waterbodies instead of to the POTW. EPA returned the forms for one of the six chemicals and requested a correction. The facility only corrected the sheet that was returned. In 1987, chemicals were purchased in fiberboard containers. Offsite transfers of some chemicals were reported to account for product retention in the drums sent for disposal. From 1988, returnable/recyclable drums of plastic construction have been used. No emissions have been reported for this waste stream. Also, the potential contribution of evaporation of dye carriers from the open equalization pit has not been considered.

When asked for comments, the contact advised that air emission calculations are only estimates. The individual stated that the standardization of MSDSs would result in improved data quality and a reduced reporting burden. Additionally, the representative suggested that EPA offer information or assistance for reporting or pollution control measures instead of making threats for noncompliance. These "scare tactics" that are often presented at seminars create an adversarial relationship between industry and government.

BACKGROUND/PROCESS FLOW

This small facility is a fabric finishing plant. The type of fabrics that are finished include cotton, cotton blends and synthetics such as rayon, polyester, and acrylic. The fabrics are knitted at a sister plant and arrive at this facility in tubular form. After slitting, the double width cloth is run through a continuous dry-cleaning machine. Next, the cloth runs through a heat setting process in which the cloth is stretched across a tenter frame to a certain width and heat is applied. This process imparts shrinkage control to the fabric. However, cotton blends do not go through this process and instead are dipped in a resin bath to control shrinkage. Next, the fabric goes through a decatering process which is similar to a pressing process. After inspection for defects and spot cleaning, the fabric is rolled and is ready for shipment.

A 4,000-gallon tank is used to store perchloroethylene as a raw material. The drycleaners have built-in condensers to reclaim the used solvent within the system. Negative pressure at the beginning and near the end of the process creates a vacuum that captures fugitive emissions and directs it to a "sniffer." The sniffer has a charcoal bed to remove the solvent from the air. The still bottoms from the condenser are further distilled to reclaim additional solvent. A 2,000-gallon tank is used to store the still bottoms for hazardous waste disposal.

TRI CHEMICAL USAGE

The sole chemical that exceeds threshold limits is perchloroethylene. It is considered to be an "otherwise use" chemical as it is used for cleaning purposes. The majority of it is used in two large dry cleaners. It is also used for spotting during the inspection process. The resin used for shrinkage control contains formaldehyde but the quantity used is below threshold levels.

COMMENTS

The 1987 report had some calculations that were somewhat confusing. To calculate offsite emissions of perchloroethylene, the preparer had assumed a figure of 30 percent of total offsite releases. It was unclear where this figure had originated and the present plant manager was unable to explain the confusion because another person, who no longer works there, completed the report. The 1988 report could not be found at the facility, in the WRMS data base or at the OWR. It appeared that it had not been submitted. It was suggested that the company resubmit the 1988 report to the EPA and the appropriate State agency. It was also suggested that breathing and working losses for the two tanks mentioned above be included in the TRI reporting. Sample calculations describing how to estimate these losses were sent to the facility.

BACKGROUND AND PROCESS INFORMATION

This large facility is a commission dyeing and finishing plant that produces approximately 1-million yards of finished fabric per week. The types of woven fabrics that are processed here are polyesters, cottons, poly/rayons, rayon/acetates, rayon/wools, and rayon/flax. Prior to dyeing, the fabrics may go through a variety of wet processes. These include desizing, scouring, and bleaching.

Next, the fabric is dyed by one of three different processes. Exhaust dyeing is performed in atmospheric jets or becks, with dye carriers, or in pressurized jets, without dye carriers. Garment dyeing is performed in equipment that is similar to washing machines. In pad-batch dyeing, open-width cloth is dyed using reactive dyes. Next, the wet fabric is rolled and turned on a rod for about 24 hours, giving the reaction time necessary for successful dyeing.

After dyeing, the fabric is finished. Finishing operations include applying resins to impart shrinkage control and permanent press characteristics, applying softeners, and Sanforizing to take the residual shrinkage out of the fabric. The fabric may then continue on to mechanical finishing processes, such as shearing or calendering.

All fabric is routed to the inspection department. Here, the fabric is blown with air to remove lint. A solvent, 1,1,1-TCA, is used to remove stains on the fabric. Finally, the fabric is graded, measured, cut, and wrapped in plastic.

There are four storage tanks onsite. Two are used to store the dye carriers, biphenyl and 1,2,4-trichlorobenzene. Resins containing methanol are stored in the other two tanks. The facility uses oil- and coal-fired boilers for heating purposes. Process wastewater is treated in their wastewater treatment system which consists of an activated sludge basin with mechanical aeration. The treated water is released to a receiving stream. The sludge is analyzed for toxicity and, for the past six years, it has been deemed safe for land application. The facility uses the sludge as fertilizer for crops such as soybeans, cotton, and bermuda grass. The crops are located on three tracts of land, one of which is onsite and two of which are at other offsite locations.

TRI CHEMICAL USAGE

The dye carriers that are used contain biphenyl and 1,2,4-trichlorobenzene. They are considered "otherwise use" chemicals and more than 10,000 lb per year are used of each. Methanol, which is a component of the resins, is also a reportable chemical. Some of the resins contain formaldehyde, which the company considers a process chemical. Approximately 15,000 lb of formaldehyde per year have been used since 1987. The solvent used for spotting contains 95.5 percent 1,1,1-TCA. They use about 2,400 lb per year of this product. The latter two chemicals fall below reporting levels.

COMMENTS

From its purchase information and MSDSs, the facility representative calculates the quantity of each of the TRI chemicals consumed during the reporting year. The facility contacts its supplier of the dye carriers to determine the fate of the two reportable dye carriers. The supplier estimated that approximately 15 percent of the biphenyl and 20 percent of the 1,2,4-trichlorobenzene are retained in the fabric after dyeing. The retained amount is assumed to be released to the air during drying. The rest remains in the wastewater prior to treatment.

Methanol is assumed to remain on the fabric after the resin finish is applied. The majority of this chemical is released to the stack during drying of the fabric.

Using the percentages mentioned above, the representative calculates the quantity of the dye carriers in the wastewater that is routed to the activated sludge basin. The facility assumes that 99 percent of the solvents in the wastewater biodegrades as a result of the activated sludge process. Water analyses from their NPDES permit gives them information on how much of each chemical is being released to the receiving stream. Sludge analyses show how much of each chemical is being released to an offsite location. The facility reported a range for fugitive emissions to take into account the handling and storing of the chemicals.

It appears the representative did not consider fugitive emissions of solvents from the wastewater in the activated sludge basin. Sample calculations illustrating this case were sent to the facility.

BACKGROUND AND PROCESS INFORMATION

This small facility is a dyeing and finishing plant of cotton and poly/cotton fabrics with an output ranging between 700,000 and 800,000 lb of fabric per week.

Tubular goods are received at the plant in the greige state. The fabric is prepared for dyeing by scouring with surfactants and then bleaching with a peroxide solution. The fabric is dyed in one of two different ways--exhaust dyeing or pad dyeing. In the former, cotton fabric is dyed in atmospheric becks and jets and poly/cotton fabric is dyed in enclosed pressurized jets. In pad dyeing, reactive dyes are used to dye the fabric. It is then allowed to sit for about 12 hours for the dye to fix onto the fabric.

After rinsing the fabric of excess dyes, it continues to a finishing process where fabric softener is applied. The fabric is transferred to a nearby sister plant to be dried and inspected. If there are major defects, the fabric returns to this facility to be reprocessed.

The facility discharges their wastewater to the POTW. During the years 1987 through 1990, the wastewater discharged was on the alkali side, having a pH of 10. During 1990, the city requested that the facility treat the wastewater to a pH of between 6 and 9 before discharge. It was at this time that the facility began to adjust the pH of their effluent by adding sulfuric acid.

TRI CHEMICAL USAGE

The TRI chemicals that were reported during 1987 through 1989 were ethylene glycol, a component of the fabric softener; tetrachloroethylene, a component of a scouring solution; and 1,2,4-trichlorobenzene, a dye carrier. Sodium sulfate and sodium hydroxide were also reported but were delisted in 1987 and 1988, respectively.

The only TRI chemical used since 1990 has been sulfuric acid for neutralization purposes. The company has strived to reduce their usage of TRI chemicals and has successfully done so. In 1987, four TRI chemicals were used and released. By 1990, only sulfuric acid was being used and, because it was used for neutralizing caustic wastewater, no actual quantities of sulfuric acid were being released.

COMMENTS

To calculate releases of the chemicals, purchasing information is used to generate a list of each product purchased during the year, the quantity purchased and the TRI chemical content. Emphasis is put on the dyes and their metal contents. Concentration information is obtained from MSDSs and a total of each TRI chemical used is calculated.

For tetrachloroethylene, 1,2,4-trichlorobenzene and ethylene glycol, the facility obtained exhaustion rates from its suppliers. From this information, they were able to calculate the fugitive, stack, and POTW emissions of these chemicals. For sodium hydroxide and sodium sulfate, the facility assumed the amount used was equal to the amount released to the POTW. The amount of metals, such as copper and nickel in the dyestuffs, is below the reporting thresholds.

By 1990 and 1991, only sulfuric acid was being used above the 10,000-lb threshold level. The facility indicated that, because no sulfuric acid was being released to the POTW, they did not submit reports for these two years. It was recommended that the facility submit 1990 and 1991 reports showing a release of zero pounds of sulfuric acid to the POTW.

The company stated that a benefit of the TRI reporting procedures is a greater awareness by the company of what chemicals are entering and leaving the plant. They study MSDSs of new products before buying them. In this way, they control the amount of carcinogens and TRI chemicals entering the facility. If they can substitute nontoxic products, they do. The facility also asks its suppliers to reformulate products in order to eliminate TRI chemicals.

For example, ethylene glycol was a component used in fabric softener to prevent freezing. Because the facility stores its softeners inside, it asked its supplier to remove the ethylene glycol. Surfactants were substituted for tetrachloroethylene in the scouring solution. To eliminate the use of 1,2,4-trichlorobenzene, poly/cotton fabrics are exclusively dyed in pressurized jets.

The facility representative commented that the State and Federal agencies should take a more active role in educating industry on preparing the forms. Seminars should be held more often. It would also be helpful if suppliers were required to complete standardized MSDSs rather than ones they create themselves.

BACKGROUND AND PROCESS INFORMATION

This smaller-than-average facility dyes and finishes approximately 23 million yards of fabric per year. The types of fabric processed are polyester and polyester/rayon blends.

The woven fabric is brought to the facility in greige state from a sister plant. All fabric is scoured in a solution containing surfactants and detergents. Fabric is dyed in pressurized jets using basic, direct, and disperse dyes. In the finishing area, the fabric is heat set in a tenter frame. A fire retardant finish may also be applied to the fabric before drying. Next, the fabric may continue to various mechanical finishing processes, which include napping, shearing, sueding, and decaturing. The finished fabric is then inspected. Stains and spots are removed with 1,1,1-TCA.

A scrubber filters the air discharged from the tenter frame stacks. Wastewater from the dyeing processes is discharged to a mechanically aerated flow equalization lagoon. After a holding time of 24 hours, the water is discharged to a POTW for further treatment.

TRI CHEMICAL USAGE

Sodium sulfate is used as a dyeing aid and the facility reported releases in 1987. In 1988, this chemical was delisted. Since 1987, biphenyl and tetrachloroethylene have been used as dye carriers and are the only reportable chemicals. Approximately 800 lb of 1,1,1-TCA per year are used for spotting.

COMMENTS

The representative responsible for completing the TRI forms for this facility has designed a computer spreadsheet that lists each TRI chemical along with the products that contain that chemical. Percentages from MSDSs and inventory information help the facility calculate the total quantity of each chemical used for the year.

During the years 1987 through 1990, the facility reported releases for biphenyl and tetrachloroethylene. A mass balance around the process is used to determine fugitive, stack, and POTW releases of these chemicals. During 1987 through 1990, the majority of the two chemicals were reported as being discharged to the POTW. The representative believes this was an error and the releases should have been reported as fugitive emissions because the solvents volatilize from the lagoon before discharge. Since 1990, quarterly water analyses have been used to determine that the amount of solvent released to the water on a yearly basis is minimal. Additionally, he stated that if he knew how much of the dye carriers were retained in the cloth prior to drying, he could better determine the distribution of solvent released as fugitive and stack emissions.

The representative stated that the TRI report helps him target chemicals for waste reduction. Recently, he has asked his supplier to reformulate a fire-retardant finish. The supplier has substituted butyl benzoate (a nonTRI chemical) for 1,2,4-trichlorobenzene. In 1991, the facility attempted to reduce their usage of tetrachloroethylene by substituting a leveling agent for the dye carrier. This was not successful because it produced dye spots on the fabric. They then substituted another product containing methyl naphthalene. This substitution proved to be effective and their usage of tetrachloroethylene was reduced by 67 percent. Their usage of biphenyl has remained relatively constant.

The facility contacts expressed their desire to participate in seminars that would aid them in completing the TRI reports. They believe that, although the state-sponsored seminars explain how to fill out the forms, they fall short in explaining how to calculate certain emissions. It was suggested that the facility contact textile trade organizations such as AATCC and ATMI to determine if they sponsor seminars on Form R reporting. It was also suggested that the facility contact their supplier of dye carriers for information on the retention rates of the solvents by the cloth. Sample calculations for estimating emissions from mechanically aerated flow equalization lagoons were also sent to the facility.

BACKGROUND AND PROCESS INFORMATION

This large facility is a dyer of polyester, acetate, cotton, rayon, and acrylic yarns. The polyester and acetate yarns are dyed by slasher dyeing. The cotton, rayon, and acrylic yarns are package dyed.

In slasher dyeing, the yarn is in filament form and passes through a solution containing a sizing compound, disperse dyes, and a resin. The sizing and resin protect the fibers from abrasion during weaving. Excess solution is then squeezed out and the fibers pass through an oven that fixes the dye and dries the yarn. The fibers are rolled on a beam and sent to another plant to be woven into mattress ticking, upholstery and drapery material.

In package dyeing, the cotton, rayon, and acrylic yarns are wound on spools called packages. They are loaded into the dye machines and a dye solution is pumped through the packages. Fiber-reactive and direct dyes are used to dye cotton and rayon while basic dyes are used to dye acrylic. Next, excess moisture is removed from the yarn by forcing heated air through the packages in a process called extraction. After drying, the yarn is wound onto cones and shipped by truck to a sister plant for weaving.

TRI CHEMICAL USAGE

In 1987 and 1988, sodium hydroxide was used in the yarn scouring process. This chemical was delisted in 1989. Melamine, a component of a resin, was reported in 1987. It was delisted for the 1988 reporting year. From 1987 through early 1993, weaving of the yarns was performed onsite. Because the looms were old, grease spots from the machinery were often deposited on the fabric. A solvent, 1,1,1-TCA, was used to remove the oil marks from the fabric.

COMMENTS

Purchase information received from product vendors was used to calculate the releases of TRI chemicals. For the 1,1,1-TCA, the facility representative who completed the TRI forms assumed that all of the solvent purchased during the year volatilized to the air as fugitive emissions. The facility reported that 100 percent of the sodium hydroxide and melamine purchased was discharged in the wastewater to the POTW.

In 1987, 45,600 pounds of 1,1,1-TCA was reported as being released to the POTW. The facility representative indicated that this was an error and the release should have been reported as a fugitive emission.

In early 1993, the facility's weaving operations were moved to a sister plant. This has eliminated the facility's usage of 1,1,1-TCA. Additionally, because the looms at the other plant are new, less grease stains are deposited on the yarn and, therefore, less solvent is being used for spotting.

BACKGROUND AND PROCESS INFORMATION

This larger-than-average facility is primarily a fabric finishing plant. The average output is 9 million square yards per week. Seventy-five percent of the output is nonwoven fabric which is used to manufacture lampshades and disposable surgical gowns. The remainder of their production is attributed to woven fabrics that are used to make parachutes and typewriter ribbon.

Nonwoven fabrics proceed to tenter frames where a number of finishes may be applied. These include water repellent, flame retardant, and other coating or resin finishes. Woven fabrics are scoured using a caustic solution before being dyed. Acid and disperse dyes are used to dye the nylon and polyester fabric in atmospheric beams and jigs. The fabric is then finished or heatset. All fabric is inspected and stains are removed with 1,1,1-TCA.

A 6,000-gallon storage tank is used to store an extender that contains xylene. The fire-retardant finish is stored in 55-gallon drums. A 5,000-gallon tank stores a finish which contains ammonia.

TRI CHEMICAL USAGE

Xylene is a component of an extender used with the water-repellent finish. Antimony compounds and decabromodiphenyl oxide are part of the fire-retardant finish. An aqueous-based coating used on nonwovens contains ammonia. A maintenance chemical contains ethylbenzene; however, it is used at a level that is below the 10,000-lb reporting threshold. Approximately four 55-gallon drums of 1,1,1-TCA are used for spotting each year.

COMMENTS

A datà base contains quarterly purchasing information. With these data and the constituent concentrations from MSDSs, a spreadsheet is used to calculate the amount of each TRI chemical used each year. For each of the four reportable chemicals listed above, detailed calculations show how the facility estimated the releases.

For xylene and ammonia fugitive emissions, emission factors are used to calculate losses from valves, seals, and fittings. Monitoring results found xylene stack emissions from the tenter frames to be minimal. Because the facility engineer believes the xylene combusts, stack emissions are assumed to be zero. However, stack releases from the extender storage tank are calculated and reported. The majority of the ammonia that is used is assumed to be released through the stack while the fabric is dried in the tenter frames.

The facility engineer assumes that the majority of the antimony compounds and decabromodiphenyl oxide is retained on the fabric after finishing. The trim (selvage) that is cut from the finished fabric is sent to a landfill. The representative calculates the amount of chemicals retained by the fabric and reports this as an offsite release.

Rinsing of storage tanks and drums generates water that is contaminated with these four chemicals. The amount of these chemicals released to the POTW is calculated and reported.

The facility contact stated that the training seminars sponsored by the EPA were helpful. He has also used the EPA publication, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form*, for obtaining equations and emission factors. The facility submits the forms on magnetic media. They have found electronic reporting to be convenient and the instructions to be straightforward.

The contact believes TRI reporting is essential for pollution prevention and they have used TRI information to help them participate in EPA's 33/50 Program to reduce their usage of xylene. Soon, the facility will be using a xylene-free extender on a trial basis. If the trial is successful, they will substitute the new product for their current extender to reduce or eliminate xylene usage.

BACKGROUND AND PROCESS INFORMATION

This small facility is a manufacturer of case goods, specifically furniture such as entertainment centers, desks, and shelving. Plywood is received from a sister plant, machined, cut, sanded, and assembled. After assembly, the pieces proceed to the finishing processes. Three coats of sap stains are applied to the wood. After applying a wash coat, which acts as a sealer, the wood is sanded by hand. The piece is then coated with a filler and proceeds to a drying oven. Next, it is sprayed with sealer, hand-sanded, sprayed with a glaze, and dried in another oven. After a coat of shade and three coats of lacquer, the piece proceeds to a final drying oven and then is polished and waxed. There are a total of 11 spray booths and 3 ovens which operate at a temperature of 175° F. The booths and ovens exhaust to the outside through stacks.

The inspection department uses products like Bondo and touch-up markers to correct any defects on the finished furniture. The goods remain in the warehouse to cure for 24 hours. They are then packaged and sent to a distribution center.

There are a total of six storage tanks onsite. Three 1,500-gallon bulk storage tanks are used to store a sealer and two different types of lacquers. Three underground storage tanks with capacities of 2,000 gallons each are used to store lacquer thinner, wash-off solvent, and Varsol. Stains are stored in 55-gallon drums.

TRI CHEMICAL USAGE

The facility's reportable chemicals are methanol, acetone, n-butyl alcohol, toluene and xylene, which are components of the stains, lacquers, glazes, and fillers. The wash-off solvents used for cleaning purposes contain acetone, toluene, and xylene. The glue used for assembly of the furniture contains vinyl acetate and is used at a level below the threshold.

COMMENTS

The facility reports fugitive and stack emissions and offsite releases. Every year, the facility receives a computer printout from its supplier listing the products purchased, the quantity bought, and the percentage of TRI chemicals in each product. From this information, the supplier calculates the total amount of each TRI chemical used for the calendar year. This service has proven to be very helpful to the facility.

The amount of solvent sent offsite for fuel blending purposes is deducted from the amount of each chemical that is purchased. Next, the amount of solvent in hazardous wastes sent offsite for incineration is determined. This figure is deducted from the total and reported as an offsite release. The remaining amount is assumed to be released to the air during the spraying and drying steps of the processes. In the 1989 and 1990 reporting years, the TRI form preparer estimated that 10 percent of the total air releases were fugitive emissions and 90 percent were stack emissions. However, in 1987, a 20 to 80 ratio was used and in 1988, a 5 to 95 ratio was used. These ratios were estimated by the form preparer.

BACKGROUND AND PROCESS INFORMATION

This larger-than-average facility is a manufacturer of high-end dining room tables and chairs. Kiln-dried lumber enters the facility to be cut, machined, and sanded. Next, the various pieces are assembled into chairs and tables with a water-based glue. The products are then finished in a long chain process consisting of 28 steps. The finishing steps include application of sealers, fillers, stains, and lacquers in partially enclosed spray booths. The chairs are air-dried between each step. The tables are air-dried also, but to speed the curing process, they may pass through drying ovens after application of some of the finishes. After finishing, all furniture is air dried for 24 hours. Defective furniture is sent to a booth to be repaired. After rubbing and buffing, the furniture is packaged and shipped to a distribution center.

A rectangular vat in the finishing area contains wash-off solvent that is used to clean spray guns and nozzles. The vat has no cover and is open to the air. Eight bulk storage tanks, each having a capacity of 3,000 gallons, are onsite. Two of the tanks store washcoats, two store lacquers and an additional two store sealers. Another tank stores lacquer reducer and the last tank is empty.

TRI CHEMICAL USAGE

N-butyl alcohol, toluene, xylene, glycol ethers, methanol, acetone, methyl ethyl ketone (MEK) and bis (2-ethylhexyl) phthalate (DOP) are chemicals that are constituents of the finishes used. These chemicals have been reported on the TRI forms since 1987. Vinyl acetate, a component of a water-based glue used for assembly, is below reporting levels.

COMMENTS

The suppliers of the finishes furnish a computerized inventory showing the amount of TRI chemicals purchased for the reporting year. The facility representative reports those chemicals whose usage is greater than 10,000 lb per year. The amount used is assumed to be released to the air as spent solvents are sent offsite for fuel-blending. For the reporting years 1987 through 1990, the contact has reported the amount used of each chemical as stack emissions. Fugitive emissions are not accounted for from the spraying operations, the storage tank area, or the open wash-off solvent container. The contact has been responsible for filing TRI reports for other facilities within this company; therefore, this omission is evident on several other facilities' reports.

In 1987, a total of 82 pounds of solvents was reported as being released to a receiving stream. The contact believes this to be an error because the facility's NPDES permit had been rescinded in 1986.

The facility electronically reported for the 1989 and 1990 reporting years. The contact believes the software should be improved to be more user-friendly. He also finds it difficult to verify the data entered. He believes that, in 1989, because of a data-entry error, the EPA entered a release of 1,400,000 lb of methanol instead of a 140,000-lb release. This error created negative local publicity for the plant. Additionally, he would like to see EPA keep the forms the same from year to year. This would ease industry's reporting burden.

As a result of filing the TRI reports, the facility has become more aware of their toxic air emissions. At other facilities within this company, HVLP spray guns were installed in 1989 and 1990. Assuming variables such as production and suite types are kept constant, the company has seen a 15 percent reduction in air emissions. By the end of 1994, the company hopes to convert to a hybrid water-based finishing system at all their facilities. It is believed this change will decrease their air emissions of TRI chemicals by 60 percent.

BACKGROUND AND PROCESS INFORMATION

This small facility is a manufacturer of high-end wood furniture case goods. Kiln-dried lumber is rough milled, glued, sanded, and assembled into case goods at this plant. Once assembled, the case goods undergo a series of 13 finishing steps, each occurring in a separate spray booth. The pieces are sap stained to even the wood tone, stained to give the piece color, and sprayed with a clear wash coat. Then the furniture is sent to an oven to dry. After drying, it is sanded to remove the raised grains, sprayed with a filler and another wash coat, and wiped by hand. As the process continues, the furniture is oven dried, sprayed with two coats of sealer, sanded, glazed, wiped, and dried in an oven again. An initial coat of lacquer is applied followed by hand padding, shading, and drying. Shade stain is applied to light areas of the wood only when needed to make the color uniform. Subsequently, a coat of lacquer is sprayed and dried twice. Finally, the case goods are hand rubbed, inspected, packaged, and sent to the warehouse.

Touchups are made using pigmented crayons, markers, and aerosol cans of stain at the inspection point. Minor repairs to the top coats of lacquer are performed in the spray booth in the inspection area. Major repairs are made by washing off the piece in a wash-off bath to remove the layers of finish. Then the furniture is refinished in line with the newly assembled pieces of furniture.

This facility has six day tanks which are used to supply the spray booths with lacquer and six 5,000-gallon bulk storage tanks. The bulk storage tanks contain sealer, lacquer, and wash coat.

TRI CHEMICAL USAGE

This facility has reported the following TRI chemicals: toluene, xylene, MEK, methanol, n-butyl alcohol, and acetone. They are components in stains, sap stains, shade stains, fillers, glazes, and lacquers. The wash-off mixture contains a solvent mixture of xylene and toluene; the markers used for touch-up work contain xylene. Polyvinyl acetate, a component of the assembly glue, and urea formaldehyde, a component of the veneer glue, are used in amounts below the threshold limits.

COMMENTS

This facility reported fugitive, stack, and offsite releases. The suppliers provide the facility with computer printouts of annual purchases which list the quantity of TRI chemicals. The quantity of solvent for offsite fuel-blending is subtracted from the total amount purchased. Using an estimation method developed by others in the furniture manufacturing business, the TRI preparer took this difference and assumed the releases were 5 percent fugitive and 95 percent stack for the 1987 reporting year and 10 percent fugitive and 90 percent stack for subsequent years.

This facility burns sawdust and other wood waste to produce steam which is used to heat the process ovens and the building. The spray booths do not have filters; however, they do have peel-coats which are removed twice each year. The spray guns are cleaned once a day by soaking the guns in solvent to remove deposits of finishing materials. The spray guns are airless and air-assist spray guns. The pallets used to transport the furniture through the process have pieces of cardboard between them and the furniture. The cardboard is removed and shipped off as hazardous waste annually. The rags used for hand rubbing are laundered locally and reused.

BACKGROUND AND PROCESS INFORMATION

This small facility is a manufacturer of high-end wood furniture case goods. The case goods undergo a series of 10 finishing steps with at least one of the steps occurring in a single spray booth. The pieces are sap stained to even the wood tone, stained to give the piece color, and sprayed with a clear wash coat. Then the furniture is sent to an oven to dry. After drying, it is sanded by hand to remove the raised grains, sprayed with a glaze, and rubbed by hand. As the process continues, the furniture is oven dried, sprayed with a coat of sealer, and sanded by hand. An initial coat of lacquer is applied followed by shading and drying. Shade stain is applied to light areas of the wood to homogenize the color when needed. Subsequently, two coats of lacquer are sprayed and dried. Finally, the case goods are hand rubbed, inspected, packaged, and sent to the warehouse.

Minor repairs are made using pigmented crayons, fill sticks, and touch-up markers at the inspection point. Major repairs are made by stripping the furniture in a wash-off bath of lacquer thinner. Once the furniture is washed off, it is refinished in line with the newly assembled pieces of furniture.

This facility has four 4,000-gallon bulk storage tanks used to store lacquer thinner, lacquer, and sealer. Seventeen to twenty-three 55-gallon drums are used daily to provide the spray booths with finishing products.

TRI CHEMICAL USAGE

This facility has reported the following TRI chemicals: toluene, xylene, MEK, methanol, and n-butyl alcohol. They are components in stains, sap stains, shade stains, fillers, glazes, and lacquers. The wash-off mixture contains xylene and toluene; the touch-up markers contain xylene, toluene, and mineral spirits. The glue used to assemble the furniture is water-based.

COMMENTS

The facility has reported fugitive, stack, and offsite releases. The suppliers provide the facility with computer printouts of annual purchases which list the quantity of TRI chemicals. The 1987 Form R reports were combined for this facility and two sister facilities and reported under another name. Therefore, this facility's TRI information was not found in the EPA database for the 1987 reporting year. The quantity of solvent sent offsite for fuel-blending is subtracted from the total amount purchased; the difference was assumed to be solely stack emissions for the 1988 and 1989 reporting years. For the 1990 reporting year, the TRI preparer estimated the fugitive emissions for each TRI chemical to be 1.65 percent of the total usage for that chemical. Stack emissions were the difference remaining after the fugitive and offsite emissions were subtracted from the total.

The 1.65 percent figure may be too low to account for fugitive emissions resulting from equipment leaks. Sample calculations showing how to use emission factors to accurately estimate these emission were sent to the facility.

Since offsite transfers were sent for fuel-blending, these releases should not have been reported for the 1988 to 1990 reporting years. Therefore, the following amounts of TRI chemicals were found to have been over-reported in each of those years:

YEAR	AMOUNT (in lb)
1988	7,760
1989	5,000
1990	11,064

Additionally, in 1990, this facility over-reported approximately 17,500 lb of isopropanol and underreported about 10,300 lb of glycol ethers.

This facility burns sawdust and scrap wood in a boiler and recycles the heat generated to heat the building. The spray booths have baffles which are cleaned with solvent. Water trays are located in the bottom of the spray booths to collect the overspray. The liquid waste is shipped offsite for fuel-blending. The pallets used to transport the furniture through the process have pieces of cardboard between them and the furniture. The cardboard is removed and shipped off as hazardous waste annually. The rags used for hand rubbing are laundered locally and reused.

BACKGROUND AND PROCESS INFORMATION

This large facility is a manufacturer of medium-end case goods including but not limited to bedroom and living room furniture.

Raw lumber is purchased and dried in kilns which use excess waste lumber as fuel. The rough mill area is where the wood is cut into boards of specific lengths and widths. The boards then proceed to the machine room where band-sawing and shaping of the wood occurs. After sanding, the pieces are assembled into a piece of furniture. The furniture then goes to the finishing room where each piece is finished by a 15-step process. The processes include application of stains, wash coats, fillers, and lacquers. The finishes are sprayed on the furniture in partially enclosed spray booths equipped with stacks. To cure the finishes, the furniture passes through two ovens after the final spraying operation. After hand rubbing and buffing, the furniture is packed and stored in a warehouse prior to shipment.

Storage tanks located outside store the various finishes. Three 3,000-gallon tanks store a sealer and two types of lacquers. A 2,000-gallon tank stores a vinyl sealer. An oil house contains between 200 and 300 drums of various finishing materials that are pumped to the finishing room by way of pipes. A covered rectangular-shaped tank contains a wash-off solvent used for cleaning. The container holds 55 gallons of solvent which is replaced once the solvent becomes spent. At each spray booth, a small container holds about one gallon of solvent to clean the spray guns. The finishing room is enclosed with no ventilation other than the stacks on the spray booths and drying ovens.

TRI CHEMICAL USAGE

During the years 1987 through 1990, there have been six reportable TRI chemicals which are constituents of the different finishes. They include methanol, toluene, xylene, n-butyl alcohol, MEK, and acetone. They are considered otherwise use chemicals. Formaldehyde, a component of the glue used for assembly, is used at a level below the threshold.

COMMENTS

The facility receives a yearly report from its coating supplier summarizing the former's TRI chemical usage. For the six reportable chemicals, each amount used is assumed to be released to the air. The corporate office has suggested the contact use a 97:3 percent breakdown to calculate stack and fugitive emissions, respectively. The contact has used this ratio from 1987 to the present. There are no offsite releases because the solvents are sent elsewhere to be recycled.

It was suggested that the facility representative use emission factors to calculate fugitive emissions from pump and compressor seals, valves, and flanges. An EPA document demonstrating how to estimate fugitive emissions from the spraying operations was sent to the contact. In this way, the contact can obtain a more accurate figure for the amount released as fugitive emissions. He may then compare this figure to the 3 percent figure to determine if the ratio the company has been using is reasonable. If not, the ratio may be adjusted to improve the quality of the data.

The company uses air-assisted spraying guns. To reduce their air emissions, they purchased HVLP guns about three years ago. The facility uses them as often as they can but the contact stated that the guns do not spray fast enough to keep up with production rates. Recently, the facility's coatings supplier has substituted alternate chemicals for the 33/50 Program chemicals in its lacquers and stains. This has resulted in a 33 percent decrease in their overall usage of the 33/50 chemicals, all of which are TRI chemicals.

BACKGROUND AND PROCESS INFORMATION

This large facility is a producer of medium-end bedroom and dining room furniture. The facility consists of the case plant and the chair plant. The former is where bedroom furniture and dining room tables are assembled and finished. The latter assembles and finishes dining room chairs. Both plants report their emissions on one TRI report.

Each plant has its own finishing room. The chairs are finished in a 22-step process. Those steps which include the use of chemicals are the application of a sap stain, a wash coat, a glaze and a topcoat. After drying in an oven, the chairs receive another application of topcoat and then are allowed to air dry for approximately three hours. At the case plant, bedroom and dining room furniture are finished in a similar 22-step process. The chair plant has five spray booths while the case plant has eight. The overspray from the topcoat spray booths is collected and reblended into the wash coat for reuse. The spray booths and ovens exhaust through stacks to the atmosphere.

Each plant has its own bulk storage area and pumphouse. There are a total of ten bulk storage tanks having capacities ranging from 2,000 to 4,000 gallons. They store lacquers, sealers, topcoats and thinners. Additionally, 55-gallon drums and 5-gallon pails containing other finishes are stored in this area. The pumphouses contain tanks in which the various coatings are mixed before being pumped to the finishing rooms.

TRI CHEMICAL USAGE

The facility uses many products containing constituents that are on the TRI list. However, only six chemicals exceed the 10,000-lb threshold level for "otherwise use" chemicals. All constituents of the various finishes, they include methanol, acetone, butanol, toluene, xylene, and chemicals belonging to the glycol ether category.

COMMENTS

Suppliers of the finishes provide the facility with a yearly report listing the products and quantities purchased and the amount of the TRI chemical contained in each product. The report summarizes the total amount of each TRI chemical used for the year. From this report the facility engineer identifies those chemicals above the 10,000-lb reporting threshold.

The amount of each chemical used is assumed to be released to the air. Of this amount, the facility engineer estimates that 1 percent is released to the air as fugitive emissions from storage of the chemical and equipment leaks. The remaining percentage is reported as emissions from stacks. This includes quantities released during the spraying and drying operations, as well as storage tank breathing and working losses. All spent solvents and hazardous wastes are transferred offsite to be fuel-blended. The contact uses a commercially available TRI software package to aid him in completing the report. He has found this to be successful because the software is able to identify potential errors.

The facility engineer stated that he had recently revised the data reported for 1987 through 1990 by submitting reports for glycol ethers during each of those years. He was not familiar with the chemicals belonging to the glycol ether family and had therefore neglected to report them. His revision also included fugitive release amounts for each of the chemicals reported in 1987 and 1988 as the previous engineer who completed the forms had neglected to report them. Additionally, the contact had noticed that the 1987 and 1988 TRI reports had been sent to the State offices only. Subsequently, he sent copies of these reports to the EPA office in Washington, DC.

During the site visit, it was found that three additional chemicals should have been reported in 1987. Therefore, an under-reporting of 33,900 lb of butanol, 13,982 lb of acetone and 14,464 lb of methanol was noted. An over-reporting was also noted of about 5,000 lb of MEK in 1988. It was suggested that revisions of these errors be submitted to the EPA and State offices. To determine if the contact's estimation of fugitive releases is sound, sample calculations using emission factors to determine fugitive releases were presented to the facility representative.

To reduce further emissions, the facility plans to use a high-solids topcoat in a step that now involves the application of three coats of topcoat. This will eliminate the usage of two spray booths and reduce the amount of chemicals being released. Trial runs, to date, have been successful and the substitution has not affected the quality of the furniture. Additionally, the contact hopes to begin using a water-based topcoat, but because of formaldehyde content, he believes that worker exposure may be an issue he will have to address.

The contact stated that the pollution prevention section on the present forms are challenging to complete because it is difficult for him to project future pollution prevention activities. He also stated that it would be helpful if the EPA would explain more clearly which chemicals belong in the glycol ether category.

BACKGROUND AND PROCESS INFORMATION

This small facility is a manufacturer of occasional tables. The tables are made of fiberboard tops and solid wood legs. The table tops are finished on a flat line while the legs and other wooden parts are finished in spray booths.

Fiberboard is purchased from suppliers in large, thin slabs. It is cut into various shapes to become table tops. The edges of the table are "finished" first by hot-stamping a strip of foil with a wood grain design. The tops are placed on a flat finishing line which is fully automated. The tops are sanded, then filled with a high-solids polyester filler. After curing by ultraviolet light, the pieces are further sanded. Two coats of base coat are applied and the pieces are dried with hot air. The tops are then routed to a printing line where five off-set rollers print a wood grain design on the pieces. After two coats of sealer, the table tops are dried.

The wooden parts are finished on a different line. First, a coat of sealer is applied. After drying in an oven, a coat of glaze is sprayed on the pieces, then a coat of lacquer. All spraying is done with HVLP spray guns. After drying in another oven, each piece is inspected for defects. Finally, all parts are assembled into tables which are then packed and ready for shipment.

A storage area contains approximately sixty 55-gallon drums of finishing material. At each of the three spray booths, there are 1-gallon pails containing wash-off solvent for cleaning purposes.

TRI CHEMICAL USAGE

The sealers, lacquers, glazes, and printing inks are solvent-based products. Reportable chemicals are acetone, toluene, methanol, MEK, butanol, and xylene.

COMMENTS

The facility receives a yearly report summarizing its TRI chemical usage from its suppliers. From these chemicals, those that are used above the 10,000-lb level are reported. The contact subtracts the amount of solvent that is sent offsite from each total. The remaining amount is assumed to be released to the air. Using the method of engineering judgment, 20 percent of this figure is reported as fugitive emissions and the rest is reported as stack emissions.

After reviewing the reports, it was found that four chemicals were not reported for the 1987 reporting year. Therefore an under-reporting of 25,053 lb of toluene, 17,101 lb of DOP, 22,026 lb of butanol, and 26,327 lb of methanol was noted.

In 1988, isopropyl alcohol should not have been reported because it was a component of a finishing product and was not manufactured by the strong acid process. An over-reporting of approximately 18,000 lb was seen. Four of the chemicals were erroneously reported as being released to land, causing an over-reporting of a total of 14,397 lb of solvents.

During the years 1988 through 90, some hazardous waste was sent offsite for incineration but the majority of it was sent to be reused in a fuel-blending program. Only the amount incinerated should have been reported as an offsite release, but the contact also reported the amount reused. The following amounts of solvent were over-reported for each year:

YEAR	AMOUNT (in lb)
1988	12,701
1989	19,041
1990	18,452

The contact stated that EPA- and State-sponsored seminars have helped them understand the report. However, since 1992, they have been using outside consultants to aid them in completing the TRI report.

As part of their waste reduction effort, the facility installed HVLP spray guns one year ago. The contact reports they have reduced the amount of finishes they use by 25 percent. Additionally, in July of this year, they will substitute water-based sealers, basecoats, lacquers, and printing inks for the solvent-based products they are currently using on the flat line.

BACKGROUND AND PROCESS INFORMATION

This large facility manufactures medium-end bedroom and dining room furniture. Rough lumber enters the facility and is kiln-dried. After cutting and machining of the wood, the parts are assembled and proceed to the finishing room. Here, spray application of various finishes takes place. The finishes include stains, fillers, sealers, and lacquers. After each step, the pieces are dried in ovens. Next, the pieces are rubbed and buffed and finally packed into boxes.

Air-assisted guns are used to spray the finishes on the wood. A 1-gallon can of solvent is kept at each of the nine spray booths for cleaning of the guns. If the finish on a piece of furniture is considered defective, the finish is removed with solvent and the piece returns to the line to be refinished. A 55-gallon drum of wash-off solvent is kept in the finishing room for this purpose.

Five bulk storage tanks, ranging in capacity from 3,000 to 4,000 gallons, store sealer, thinner, and three kinds of lacquer. A drum storage area stores other finishing materials. Finishing materials are pumped to the finishing room by way of pipes from a pumphouse that is located near the storage area.

TRI CHEMICAL USAGE

Chemicals subject to reporting are found in the wash-off solvent and various finishes and include toluene, methanol, xylene, acetone, MEK, butanol, and glycol ethers.

COMMENTS

The facility receives a yearly report summarizing its TRI chemical usage from its coatings suppliers. The amount used of each chemical is assumed to be released to the air and is reported as stack emissions. Overspray collected from the spray booths is sent offsite for fuel blending and spent wash-off solvent is sent offsite to be recycled. The disposal facility sells the reclaimed solvent back to the company to be used again.

In 1990, an over-reporting of nearly 92,000 lb of isopropyl alcohol was seen. This chemical need not have been reported as it was otherwise used at this facility and was not being manufactured. Fugitive emissions from leaks in pump and compressor seals, valves, and flanges were not accounted for. It was suggested that the facility use emission factors to estimate these releases. Sample calculations describing this were shown to the contact.

In the past couple of years, the facility has eliminated its release of xylene and reduced its release of toluene by approximately 15 percent. These changes have come about as a result of the reformulation of certain finishing products by the facility's suppliers.

BACKGROUND AND PROCESS INFORMATION

This large facility manufactures household furniture such as bedroom furniture. Prior to 1988, the facility finished wood furniture using traditional coatings and finishes in spray booths. Since that time, they have virtually eliminated their spray lines by laminating the "finishes" onto the fiberboard. The "finishes" are actually sheets of paper with a wood grain design that are glued onto the pieces of fiberboard. Small parts, however, such as table legs, are sprayed with stains, sealers, glazes, and lacquers on two different finishing lines.

Bedroom furniture is given a colored-lacquer look by passing through a polyester finish line, which was installed in 1992. A urethane-topcoated paper is glued onto the fiberboard. After sanding, an insulator is applied to the surface of the fiberboard so that sealer can adhere properly. The sealer, which is 100 percent polyester, is then applied. After ultraviolet curing, this process is repeated. Next, the pieces are polished and a pigmented 100 percent polyester topcoat is applied. After curing with ultraviolet light, the pieces are cooled with outside filtered air. If defects are found during inspection, the pieces are reprocessed.

Four 4,000-gallon bulk storage tanks contain two types of lacquers and two types of sealers. A storage area contains approximately sixty-five 55-gallon drums of other finishing materials. A pumphouse contains day tanks from which finishing materials are pumped to the finishing lines.

TRI CHEMICAL USAGE

The finishes used contain various SARA 313 chemicals. However, the reportable chemicals are MEK, toluene, butanol, xylene, methanol, acetone, and styrene. The glues used to adhere the finish paper to the fiberboard contains formaldehyde, but not enough to trigger reporting thresholds. The polyester sealers are 100 percent solids and contain no VOCs.

COMMENTS

The facility receives, from its suppliers, a list of all TRI chemicals contained in the products purchased during the year. The report also provides a summary of the amount of each TRI chemical used for the year. The facility contact identifies those chemicals with amounts greater than 10,000 lb, which is the threshold for otherwise used chemicals. After subtracting the amount of solvent which is sent offsite for fuel-blending and/or incineration, the remaining amount is assumed to be released to the air. Twenty percent of the total is reported as fugitive emissions and the rest is reported as stack emissions.

In 1987, the facility's records showed that three chemicals were not reported. Hence, an under-reporting was seen for 39,656 lb of methanol, 19,372 lb of styrene, and 62,634 lb of DOP. All are considered "otherwise use" chemicals.

In 1988, the contact mistakenly reported some chemicals as being released to the land when this was not the case. An over-reporting of a total of 30,100 lb of the various chemicals reported was seen.

During the reporting years 1987 through 90, most of the facility's hazardous waste was sent offsite for fuel-blending with the rest being sent offsite for incineration. Only this latter amount should have been reported because fuel-blending is considered a recycling or reusing activity. Consequently, the following total amounts of TRI chemicals were found to have been over-reported for each of those years:

YEAR	AMOUNT (in lb)
1987	22,219
1988	6,822
1989	8,703
1990	765

. As a result of the process changes made, the TRI data show that the facility has seen a 73 percent reduction in their release of SARA 313 chemicals from 1987 to 1990. Reductions may also be seen once the facility completes its 1992 Form R, because during that year the polyester finishing line was installed.

BACKGROUND AND PROCESS INFORMATION

This small facility manufactures medium-end dining room tables, entertainment centers, and bedroom furniture. Raw lumber is brought to the facility, is kiln-dried, cut and machined into wood parts. After assembly, the pieces of furniture proceed to the finishing room where they are finished in an 18-step process. The steps include application of stains, sealers, fillers, glazes, and lacquers. After rubbing and buffing, the furniture is packaged.

The spraying of most of the finishes is achieved by HVLP spray guns. However, air-assisted guns are used to spray the sealers and lacquers because the HVLP guns cannot keep up with production rates. In the finishing room, there is a wash-off solvent tank with a capacity of 165 gallons that is used to remove the finish from defective furniture. Usually, it is kept only half full and when not in use, it is kept covered.

Four 3,000-gallon bulk storage tanks store lacquers and sealers. A 2,000-gallon storage tank is used to store thinner. Nearby, a covered drum storage area stores about 130 drums of raw materials. The pumphouse is where the various finishes are formulated and pumped by way of pipes to the finishing room.

TRI CHEMICAL USAGE

Reportable chemicals that are constituents of the finishes include acetone, butanol, xylene, toluene, MEK, methanol, and methyl isobutyl ketone (MIBK). In 1987, formaldehyde, a constituent of the assembly glue, was reported.

COMMENTS

The facility's coating suppliers furnish yearly reports summarizing its usage of TRI chemicals. These figures are adjusted to reflect beginning and ending inventories. Hazardous waste being sent offsite for incineration is analyzed to determine the amount of each solvent contained in the waste. This figure is subtracted from the yearly amount used and the remaining quantity is reported as stack emissions.

Fugitive emissions from leaks in pump and compressor seals, flanges, and valves are not considered. Sample calculations to estimate these types of releases by using emission factors were given to the contact.

To reduce their usage of solvent, the facility plans to use a company that performs on-site distillation of solvents. In this way, the facility hopes to recover and reuse up to 80 percent of their spent solvents. The facility's release of formaldehyde has fallen below threshold levels since 1987 due to a reformulation of the assembly glue by the supplier.

BACKGROUND AND PROCESS INFORMATION

This moderately sized facility manufactures solvent- and water-based finishes for wood and metal finishes for original equipment manufacturers (OEM). Output for the single-shift operation is placed at just over 1.5 million gallons per year. Approximately 65 percent of the business is devoted to furniture coatings. Last year, sales of water-based coatings for wood were twice those of the previous year. This year, sales of water-based coatings are expected to be three times those of last year.

The facility has one laboratory that is devoted to quality control, shade matching, and research for UV coatings. Another laboratory performs general research and development work for other coating systems.

There are two production buildings. One is devoted to batches that range in size from 5 to 275 gallons. The other is for 30- to 2,000-gallon batches. Dry pigments are preweighed in a vented hood and loaded onto a pallet before being transferred from the warehouse to the production area. Other components such as solvents and resins are added to the pigments in the production areas. In the large-batch area, vapor and particulate emissions are discharged to a baghouse. The system uses vents that are placed where mixing, blending, dispersion, and/or grinding occur. Wall-mounted exhaust fans assist with the ventilation. The small-batch area only has wall-mounted exhaust fans.

As each batch is filled off, it is filtered. The cloth filter bag is rinsed with solvent and reused in the next batch that is similar in color and composition. After several uses, the filters are sent offsite for incineration. Bottoms from the solvent recovery still that was operated from 1987 to 1990 and dirty rags and paper cups for measuring and sampling were also incinerated during those years.

Twenty-two raw material bulk storage tanks are located behind the facility. Solvents are transferred by pipe to the production buildings. An open trough collects drips from the pipe header. This solvent mixture is used for vessel cleaning. When the blend is spent, it is sent offsite for recycling. Three bulk storage tanks for resins are located in a heated room within the production area. Tank vents are routed through the roof.

TRI CHEMICAL USAGE

Most chemicals that are reported by this facility are solvents used in products. These include acetone, ethylbenzene, methanol, MEK, MIBK, n-butyl alcohol, toluene, and xylene. A plasticizer, DOP, is also used. Because the marketplace wants to avoid coatings with such heavy metals as chromium and lead, use of these components is at a level below the reporting threshold.

COMMENTS

The contact stated that it has been difficult to obtain the reporting forms. The forms were requested from the TRI Hotline several times but were never received. According to the contact, the personnel who staffed the Hotline did not want to forward the reporting material because they incorrectly believed that the forms had already been received. One year, the forms had to be obtained from a trade organization.

Constituent concentrations from new and revised MSDSs are entered into a computer to determine whether thresholds are met. In most cases, the 10,000-lb threshold is used for reporting. To illustrate an exception, the 1987 usage of MIBK was approximately 15,000 pounds and the facility chose to list emissions from this chemical. Approximately 49,000 lb were used during the next year. That year the facility used the higher, "manufacture or process" threshold. Because this did not exceed 50,000 lb, emissions from MIBK were not listed.

Also in 1988, purchasing records indicated that over 135,000 lb of ethylene glycol butyl ether were ordered. The contact was not aware that this chemical is a glycol ether. Records for 1990 depicted these purchases approaching 180,000 lb. Glycol ethers are not listed on the 1987 through 1990 reports for the facility.

In 1987, emissions of DOP were reported. No emissions of DOP were listed the next year. The contact indicated that several chemicals, DEHP and DIDP, can be used interchangeably with DOP. The batch tickets called for, and the storage tank was labeled, DOP. According to the contact, because of substitution, DOP was not used in an amount over the threshold reporting level. We were not able to discern the identity of these other raw materials.

Several of the raw material feedstocks are blends that contain reportable constituents. For example, the MSDS for lactol spirits discloses that the mixture contains 10 to 18 percent toluene and 1 to 3 percent cyclohexane. According to the MSDS for varnish makers' and painters' (VM&P) naphtha, less than 8 percent xylene and less than 2 percent ethylbenzene are present. Xylene that is purchased by the facility contains 10 to 25 percent ethylbenzene. With the exception of 1987 when emissions of ethyl benzene were reported, these constituents are not included in any calculations. Therefore, the facility is under-reporting emissions of xylene and ethylbenzene.

Emissions from the large batch area are considered to be point emissions because of the vacuum ventilation system. At the visit, it did not appear that the system was capable of removing all the vapors from the process to the stack. Emissions from the small-batch area are considered to be fugitive. Air emissions are calculated by multiplying the gallons of a specific chemical that is processed by 0.134 to obtain the number of pounds per hour emitted. This results in an emission factor of 1.6 to 2.0 percent, depending on the density of the chemical. This number is partitioned between the fugitive and point release estimates, depending on the ratio of chemical usage in each production area.

To calculate point emissions from bulk storage tanks due to loading, working, and breathing losses, the contact uses a computer programmed with the equation from the EPA publication *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form.* Fugitive emissions from valves are estimated using emission factors. Next, the inventory variance is determined. Variance equals amount purchased plus beginning inventory minus amount used minus ending inventory. This variance is partitioned between fugitive and stack emissions in proportion to the ratio of the small- to large-batch area production.

The contact uses a gas chromatograph to analyze water in the duck pond below the facility. This is to ensure that hazardous chemicals are not contained in stormwater runoff.

Although the individual claims to have submitted the TRI forms for reporting years 1989 and 1990, hard copies were not found at the OWR. A search of the TRI data base was unsuccessful at locating emissions from those years. As a result, 1989 air and offsite emissions of approximately 48,000 and 263,000 lb, respectively, are not in the data base. The untallied air and offsite emissions in 1990 are approximately 53,000 and 253,000 lb, respectively. We suggested that the forms be resubmitted.

When asked for comments, the individual noted that the data quality is adversely affected when suppliers report a range for the constituent concentrations. Although his calculation scheme separately accounts for fugitive and point emissions, he stated that, in his opinion, it does not matter how the emissions are partitioned between the two, as long as the sum is accurate. He also noted that a significant portion of his time was spent helping customers with their reporting. This includes generating reports that sum the chemical constituents purchased each year and aiding with the calculation of breathing, working, and loading losses from bulk storage tanks.

BACKGROUND AND PROCESS INFORMATION

This small facility is a single-shift operation that supplies wood coatings to manufacturers of kitchen cabinets and furniture. These products include solvent-based stains, sealers, and nitrocellulose lacquers, and UV-curable coatings. Some primers and enamels for opaque wood finishes are produced. Within the last year, sales of water-based coatings have started.

The plant has a quality assurance and a research and development laboratory. A laboratory-scale UV curing oven and a ball mill is adjacent to the latter. Each laboratory has a small spray booth that is vented to a stack. Production is carried out in two mix rooms. Raw materials that are received in drum quantities or smaller are stored in another room. A tank farm for bulk storage of raw materials is outside. Goods are shipped in quantities ranging from one gallon to a tanker load. Finished goods in drum quantity or less may be stored in the mix rooms prior to shipping.

Products are prepared by mixing pigments, resins, and solvents in tanks with high-speed mixers. Two ball mills located in the basement are used when further dispersion or grinding is necessary. Several wall-mounted exhaust fans maintain air flow and transport fugitive emissions to the outside. As the product is pumped from the mixing vessel into the shipping container, it is passed through filter media which is placed in the funnel opening. Bag-type filters are also used.

TRI CHEMICAL USAGE

The facility uses acetone, DOP, MEK, MIBK, toluene, and xylene in formulations. With the exception of DOP, which is used as a plasticizer in lacquers, these chemicals are used as solvents in coatings formulations or as components of lacquer thinner. Lacquer thinner is used to clean solvent-based finishes from process tanks. This formulation is produced on-site from a blend of solvents that includes n-butyl acetate, lactol spirits, methanol, MEK, MIBK, naphtha, and toluene. Thinner is reused until the cleaning efficiency diminishes. Cleaning wastes are stored in closed drums until shipped offsite to a fuel-blending program. Cleanup of water-based finishes is performed with water, which is reused until the cleaning efficiency diminishes. This waste is added to a drum that contains waste filters and cleaning rags. These drums are also transported to a fuel blending program.

The facility has five horizontally oriented (10,150 gallon) and two vertically oriented (10,000 gallon) storage tanks. Three of the five horizontal tanks are partitioned into three, nearly equal-capacity sections. Materials stored in the tanks include acetone, n-butyl acetate, ethanol, isobutyl alcohol, 95 percent isopropyl alcohol, lactol spirits, lacquer thinner, methanol, MEK, MIBK, mineral spirits, naphtha, and toluene.

COMMENTS

The person that completed the 1987 through 1990 Form R reports is no longer employed by the company. Point emissions from tank working and breathing losses were not included as part of this facility's TRI report. Because mixing and tank cleaning occur in open vessels, fugitive emissions should also be estimated. Using purchase records supplied for one year and the AP-42 emission factor of 30 lb of nonmethane VOC emitted per ton of product, combined fugitive air emissions of acetone, MEK, MIBK, toluene, and xylene would be over 15,000 lb per year. Maximum emissions listed on an air permit are of the same magnitude.

The methodology and calculations that were used for waste that was shipped off-site appear accurate. The facility has a septic tank for wastewater disposal. Only sinks, showers, and toilets discharge to this system. The facility does not discharge to a POTW, so the reported emissions (zero) to this media are correct.

Facility records indicate that for the 1987 reporting year, two submissions of TRI data were made. The reason for this was unclear. The facility has kept copies of only the second submission. This submission was not marked as a correction. As a result, the pounds listed as being emitted on the WRMS data base are approximately twice what was intended to have been reported. The TRIS data base lists only the latter submission.

Two partially completed forms were found in the 1989 files. Data entered on these forms included only the facility information and the chemical identification. No release estimates were present. The WRMS data base does not list emissions for these chemicals so it appears that submissions were not made for DOP and methanol. The contact did not know if these forms should have been completed. Present consumption is at a level above the 25,000-lb annual threshold. So, if past usage levels are similar, the facility should have reported emissions of these chemicals.

Neither WRMS nor TRI had 1990 emissions data for this facility. When asked, the facility contacted the individual who was responsible for the 1990 submission. He stated that the forms were requested from the State but were never received. Therefore, no submission was made.

The representative stated that the 1991 forms were submitted on magnetic media. They could not locate hard copies. The burden of reporting seems to be beyond the means of facility personnel. The facility representative stated that reporting for 1992 is likely to be delegated to a paid consultant.

BACKGROUND AND PROCESS INFORMATION

This medium-sized facility manufactures paint as a secondary operation. Paint accounts for less than 2 percent of the facility output. The business is primarily engaged in the production of polyester gel coats that are sold into the cultured marble industry. These gel coats are used to finish vanity tops. The fiberglass boat industry consumes some of these coatings as well. Approximate daily shipments are placed at 45,000 lb. Production operations involve only physical grinding or mixing; no chemical reactions are performed.

Raw materials are stored in a warehouse or in bulk storage tanks. Resins, which account for 95 to 97 percent of the formulation, are piped from the storage tanks into a mix tank. Pigments, driers, and wetting agents are added from bags or drums. The facility uses roller mills and sand mills to grind the pigments, which increases gloss and improves color yield. Batch sizes range from 50 to 15,000 lb.

Some gel coats are sold as clears, for topcoats, others are supplied as custom-blended colors. Some customers purchase tinting agents to adjust the shade or create color effects. To use this gelcoat, the customer blends the monomer with a peroxide-based catalyst, or hardener, which contains 9 percent MEK. The facility distributes prepackaged catalyst. When blended, the styrene monomer crosslinks, or polymerizes, and hardens. Because these coatings are 100 percent polymerizable, the cure step does not rely on the evaporation of a solvent, unlike traditional solvent-based finishes.

The paints that the facility manufactures are used to touch up scratches and chips in these gel coats. These paints are polyurethane-based. Other products that are produced in small volume include a two-part polyurethane system which is cast into bowling balls. The customer blends a polyol base with a reactant containing diphenylmethane diisocyanate (MDI) to produce the ball. Another product is produced by grinding and dispersing dry pigments into a resin base to make tinting agents for the gel coats.

As the product is transferred to shipping containers, bag filters are used to remove particles larger than 50 µm. Products are shipped in containers in sizes ranging from 1-gallon buckets to 275-gallon totes. If necessary, the finished goods are stored in a warehouse prior to being shipped.

Mix tanks are cleaned with acetone. A 5-gallon bucket that contains 1 or 2 gallons of acetone is placed in the mix tank. A long-handled brush is used to spread the solvent about the tank. Pails and buckets are cleaned in a wash tank that contains acetone. Spent cleaner is recovered in a 60-gallon solvent recovery still. Of the material entering the still, 75 percent is recovered for reuse. Recovered acetone is kept in a covered holding tank. Still bottoms and used bag filters are shipped to a fuel blending program. Other liquid wastes are incinerated.

The facility has a laboratory for quality control, customer service, and research and development. The laboratory has a vented spray hood that is used once per day.

TRI CHEMICAL USAGE

Most releases of TRI chemicals are the result of vapor loss in manufacturing. The two chemicals used above reporting thresholds are styrene and acetone. Small amounts, a few hundred pounds per year, of xylene and toluene are purchased for incidental uses. Annual sales of the hardener that is distributed contain less than 400 lb of MEK.

COMMENTS

Emissions from each bulk storage tank are calculated. When added, these account for all point emissions at the facility. The contact uses the equation for vertical tanks in the document, *Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form.* The same estimate is used for a horizontal tank that is also present. The contact noted that the correlation would not accurately predict emissions from horizontal tanks. He stated that horizontal tanks are common in the industry, and an accurate estimation method should be published for such vessels.

There is one vertically oriented xylene storage tank inside the facility. Because it is not vented to the outside, the contact uses the tank calculation to estimate fugitive emissions. Then, data obtained from the monitoring of plant air are used. It has been determined that the air contains an average of 11 parts per million of xylene. Using the ideal gas law, the cubic feet of air contained within the plant, and assuming one air change per day, the contact obtained annual emissions of xylene. This number is added to the contribution from the interior storage tank. He was instructed that this technique double counts emissions from the tank. Another error is the assumption that one air change per day occurs. Loading dock doors are left open in the production area. Additionally, there are five wall-mounted exhaust fans. A more realistic assumption of two air changes per hour would increase emissions for the single-shift operation by a factor of 16.

To calculate releases of acetone, usage is obtained by subtracting the ending inventory from the sum of the beginning inventory and the purchases. Offsite transfers of liquid waste have been analyzed to determine the acetone content. The amount of acetone that is incinerated is subtracted from the usage to obtain fugitive emissions.

Releases to the POTW are not likely because there are no processes that are piped to the sewer. Noncontact cooling water for the grinding mills and the distillation unit is recirculated in a closed loop through a chiller system. The facility has a boiler for heating the plant. Blowdown is discharged to the POTW.

BACKGROUND AND PROCESS INFORMATION

This large facility produces approximately 300,000 tons per year of water-based architectural and wood furniture coatings, high gloss polyester coatings for wood, and traditional, solvent-based wood finishes. Nearly one-fourth of the output is water-based. The plant has separate production areas dedicated to lacquers, stains, polyester coatings, and water-based coatings. There are 35 external raw material storage tanks for products that are received in bulk. Materials may also be received in totes, bags, or drums.

Products are manufactured by blending solvents, resins, and pigments in batch sizes that range from 5 to 5,000 gallons. The facility has several ball mills for grinding and dispersing the pigments. Vapors are removed from the production areas by vents located at each tank and by wall-mounted exhaust fans. Because the pigments used in the water-based production area are dusty, the vents in this area are routed to a baghouse.

When a batch is drummed off, it is passed through filter bags. Product is shipped in sizes that range from 1-gallon pails to tank trucks. Mix tanks are cleaned with solvents which are reused until spent. An outside service uses a mobile recovery still when the facility accumulates 8,000 lb of spent cleaning solvent. After reclamation, the batch will yield 6,000 lb of solvent.

There are laboratories for quality control and research and development purposes. Several small spray booths are located in the laboratories and plant. In these laboratories, vents are used to transport solvent vapors from the workplace to the outside. A building for customer service has several small finishing lines, spray booths, and driers which are vented to the outside.

The facility has a waste water treatment plant (WWTP) with some biological action for the purpose of reducing chemical oxygen demand (COD). However, biological treatment did not begin until 1992. The WWTP discharges to the local POTW. Tank rinsings from the water-based production area are a significant source of the COD loading.

TRI CHEMICAL USAGE

Most of the reportable chemicals that are used are solvents. These include acetone, n-butyl alcohol, ethylene glycol, glycol ethers, methanol, MEK, MIBK, styrene, toluene, and xylene. No DOP is used at the facility. Metals are not used in an amount that meets or exceeds the threshold.

COMMENTS

Since the 1990 reporting year, corporate headquarters has generated a report that lists the quantities of raw materials purchased by chemical constituent. Facility personnel use this to determine whether thresholds are met. In earlier years, these calculations were performed manually.

Since 1988, storage tank losses have been calculated using SARA 313, a program developed by DuPont. During the visit, the 1987 reports and supporting documentation were not located. If point emissions from storage tanks were included that year, they would have been calculated manually.

Fugitive emissions are calculated using plant air sampling data that was collected to ensure adequate workplace hygiene. These analyses are the basis for determining average concentrations of chemicals in parts per million. At the same time, monitoring was performed to determine average volumetric air flow rates in cubic feet per minute. These data are updated every other year for each production area.

At the visit, we recommended that production adjustments be made to account for changes in manufacturing volume instead of repeating the data from the previous year when no new data are available. The assumption that all production emissions are fugitive in nature disregards the ducted ventilation system which discharges to a stack. Therefore, we suggested that the fugitive emission estimate be partitioned between the stack and fugitive release categories.

Still bottoms and dirty reclaimed solvent are either incinerated or sent to a fuel blending program. The methodology for reporting emissions for offsite transfers is sound.

Although ethylene glycol is used in amounts above the threshold, the facility did not list emissions, zero or otherwise, of this chemical during the reporting years 1987 through 1990. It seems that the contact believed he is not required to list a chemical when no releases occurred. However, the potential for fugitive emissions, point emissions, and releases to the POTW exists. Air emissions from a variety of processes (e.g., product storage, transfer, and mixing) should be considered. When water-based mix vessels are cleaned, the rinse water is sent to the WWTP. The likelihood that ethylene glycol would eventually be discharged to the POTW was not addressed.

BACKGROUND AND PROCESS INFORMATION

This large facility manufactures solvent and water-based wood finishes and metal original equipment manufacturers finishes. Coatings for wood furniture account for approximately 85 percent of the business. A recent business acquisition is likely to result in a 50 percent increase in sales of waterborne coatings. Raw materials are received in tank truck, tote, and drum quantities. There are 32 outside storage tanks for raw materials. Purchasing of all materials is handled by a central department. Product is shipped in 1- or 5-gallon pails, drums, totes, or by tank truck. The single-shift operation manufactures approximately 350,000 gallons per month.

Solvents, pigments, and resins are blended, milled, and/or dispersed in open vessels. Tank capacities range from 1,200 to 3,500 gallons. When pigments are charged to these vessels, dust is vacuumed from the area through a vent at each tank. A baghouse filters the stream. Each batch is evaluated in a quality control lab prior to packaging or "filling off." The facility has four other laboratories devoted to various research and development functions. In these labs, there are 14 spray booths with hoods vented to exterior stacks.

Mixing vessels used for solvent-based finishes are cleaned with a blend of solvents. This blend is recycled in a thin film evaporator that is onsite. The still bottoms are shipped offsite to a fuel blending program. Prior to 1990, this stream was incinerated. Filters are also shipped offsite to a fuel blending program. Water that is used to clean water-based coatings from mix tanks is shipped offsite.

TRI CHEMICAL USAGE

Solvents account for most of the chemicals that are reported. These include acetone, n-butyl alcohol, ethyl benzene, glycol ethers, methanol, MEK, MIBK, toluene, and xylene. Other reportable chemicals that are used include barium and zinc compounds and a plasticizer, DOP. As the years progressed, the use of heavy metals such as lead, cobalt, chromium, and barium has been reduced to levels that are below the reporting thresholds.

COMMENTS

A corporate environmental department has endorsed the use of certain emission factors for most estimates. Fugitive emissions of solvents are calculated by multiplying usage by 1.5 percent. The contact did not know whether this factor includes emissions from leaking pipes, valves, and fittings. If not, these sources are not included. Fugitive emissions of solvents from bulk handling are based on a chemical-specific factor that ranges from 0.008 to 2.61 lb per 1,000 gallons processed. Fugitive emissions of pigment dust is 1.0 percent of usage.

Point emissions of pigment dusts are estimated by multiplying usage by 1.0 percent and by the quantity, one minus the filter efficiency. Point emissions due to breathing and working losses from tanks were calculated in 1988 using software developed by Unocal.

Emissions for a subsequent year are determined by multiplying emissions from the previous year by the ratio of present year's usage over previous year's usage. It was not clear if tank emissions were considered in 1987. Point emissions of solvents from the baghouse are not considered because the system pulls vapor and dust only when charging pigments.

A percentage of the weight of the raw material bags that are sent to the landfill is reported to account for product retention in the packaging. An allowance is made for chemicals retained in filters that are sent offsite. The constituent concentrations for still bottoms are known. So, for the reporting years 1987 through 1989, when bottoms were incinerated, the weight shipped offsite was multiplied by the constituent concentration.