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Process Waste Assessment Paint Shop

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PROCESS WASTE ASSESSMENT

PAINT SHOP

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ABSTRACT

This Process Waste Assessment was conducted to evaluate hazardous wastes generated in the Paint Shop, Building 913, Room 130. Special attention is given to waste streams generated by the spray painting process because it requires a number of steps for preparing, priming, and painting an object. Also, the spray paint booth covers the largest area in Rm. 130. The largest and most costly waste stream to dispose of is "Paint Shop waste"—a combination of paint cans, rags, sticks, filters, and paper containers. These items are compacted in 55-gallon drums and disposed of as solid hazardous waste. Recommendations are made for minimizing waste in the Paint Shop. Paint Shop personnel are very aware of the need to minimize hazardous wastes and are continuously looking for opportunities to do so.

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PROCESS WASTE ASSESSMENT PAINT SHOP

Introduction

Department of Energy (DOE) Orders 5400.1 and 5400.3 mandate the development of a waste minimization program.^{1,2} The program's goals are to:

1. reduce volumes of hazardous wastes and their toxicity,
2. implement a system of tracking and reporting improvements, and
3. devise a method for performing assessment and minimization tasks.

To satisfy the requirements of this program, process waste assessments (PWAs) are conducted to identify waste generating processes. The data collected from a PWA is used to identify waste minimization opportunities.

This PWA was conducted to evaluate hazardous waste generation in the Paint Shop, according to the revised Sandia *Process Waste Assessment Plan*.³ The focus of this PWA is the hazardous chemical waste streams generated by painting processes. Special attention is given to waste streams generated by the spray painting process.

Summary

The Paint Shop (Bldg. 913, Rm. 130) provides SNL/California a variety of painting support. The painting capabilities of the shop include the following:

- spray painting of all types of metal and wooden objects;
- brush and roller painting;
- striping of site roadways and parking areas;
- sign painting; and
- R&D testing of paints for application in weapons programs.

The spray paint booth is located in Rm. 130 and occupies most of the floor space. The booth is designed with both flow-through and down-draft air filtering systems. Air is drawn through a full bank of filters at one end of the booth and is passed through accordion filters at the other end. Air also is drawn down through a grate and through an exhaust system under the floor. This system is designed around a pit containing a maze of z-shaped air deflectors that collect the paint over-spray. All spray painting is done over the down-draft grating so that the over-spray will be drawn into it.

The primary hazardous waste streams routinely generated by the Paint Shop are:

- waste solvents and thinners,
- "Paint Shop waste"—a combination of paint cans, rags, sticks, filters, and paper containers; and
- aerosol cans.

The other waste streams have been scrutinized by Paint Shop personnel, who have taken steps to minimize them where possible. For example:

- Where practical, disposable brushes and rollers are used to avoid generation of waste cleaning solvents.
- Generation of waste cleaning solvents is also avoided by using disposable paper cups and tubs for transferring and mixing spray paints.
- When water-based paints are used, the brushes, rollers, and buckets are washed clean with water and reused.
- Wooden stir sticks are reused as many times as possible before they are discarded.

A material balance was done on the spray painting process using the data available from the Environmental Protection Hazardous Waste Container Logs and from summary data reported to the Bay Area Air Quality Management District (BAAQMD).⁴

Overall, the shop personnel are very aware of the need to minimize hazardous wastes and are continuously looking for opportunities to do so.

Process Waste Assessment

Facility

Paint Shop

Products

A variety of painted surfaces

Process Description

The Paint Shop, Bldg. 913, Rm. 130, provides painting support to SNL/California. The shop area layout is shown in Fig. 1. Room 130 primarily contains the spray paint booth. The remaining area is used for office space and support for the other paint processes.

The painting capabilities of the shop include the following:^{5,6}

- spray painting of all types of metal and wooden objects including weapons and miscellaneous related parts, office furniture, cabinets, and cable trays;
- brush and roller painting of facility walls, floors, and structures;
- striping of site roadways and parking areas;
- sign painting, glass cutting; and
- testing of paints for application in weapons programs.

Figure 2 shows a process flow diagram for the facility.

The spray booth is designed with flow-through and down-draft air filtering systems. One end of the booth has a full bank of filters in the doors and inlet air is drawn in through these filters. The flow-through air is filtered through accordion filters at the opposite end of the room. These accordion filters are replaced when shop personnel determine they are dirty. Normally, this replacement occurs approximately every six months. However, if less spray painting is done, the filters may be used for up to a year.⁶

The down-draft exhaust system is located under the floor of the spray paint booth. The system is designed around a five-foot deep pit lined with galvanized steel, containing a maze of permanent z-shaped air deflectors. The air is drawn down into the pit through the grate and through the

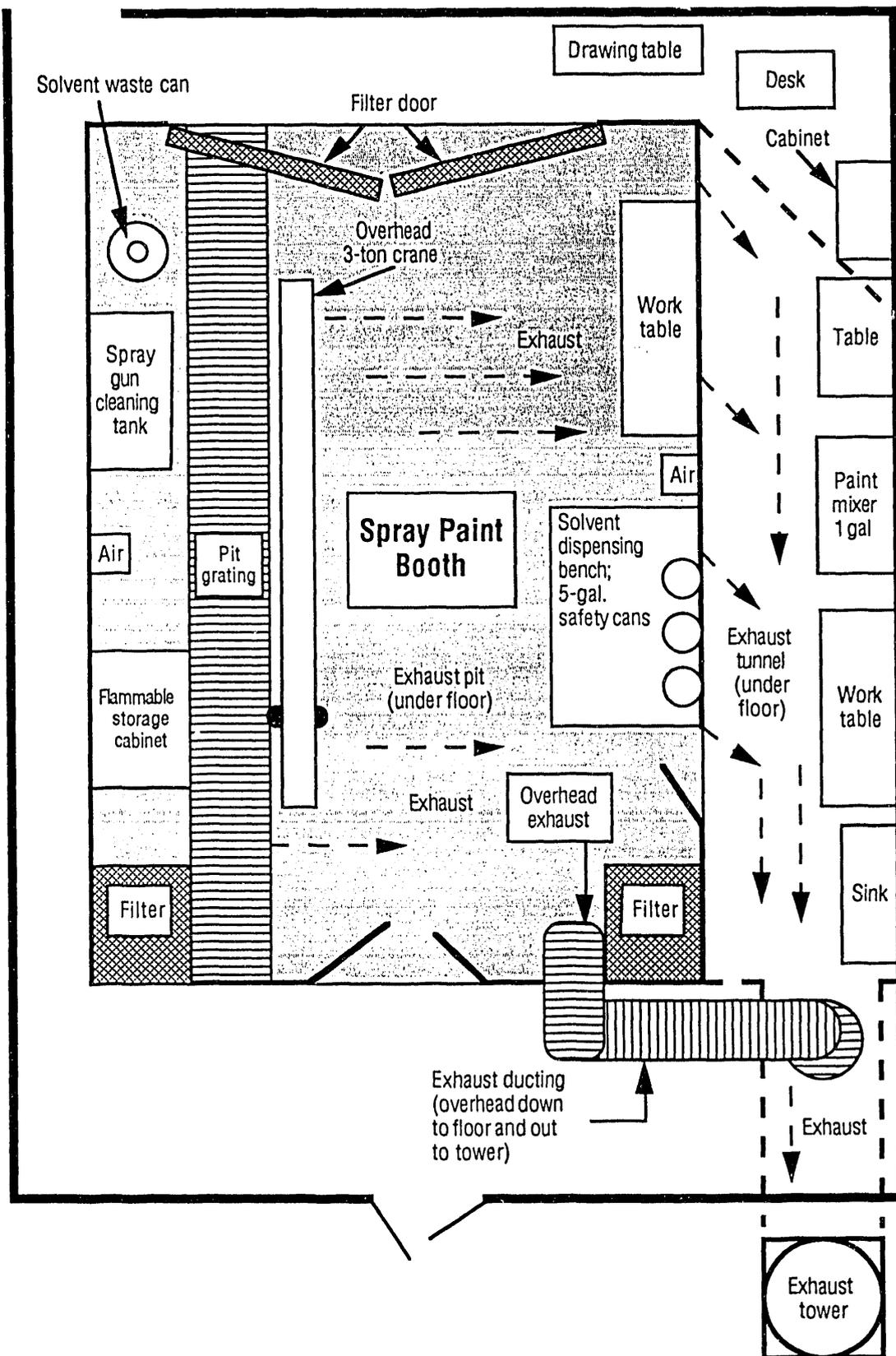


Figure 1. Paint Shop Area Layout.

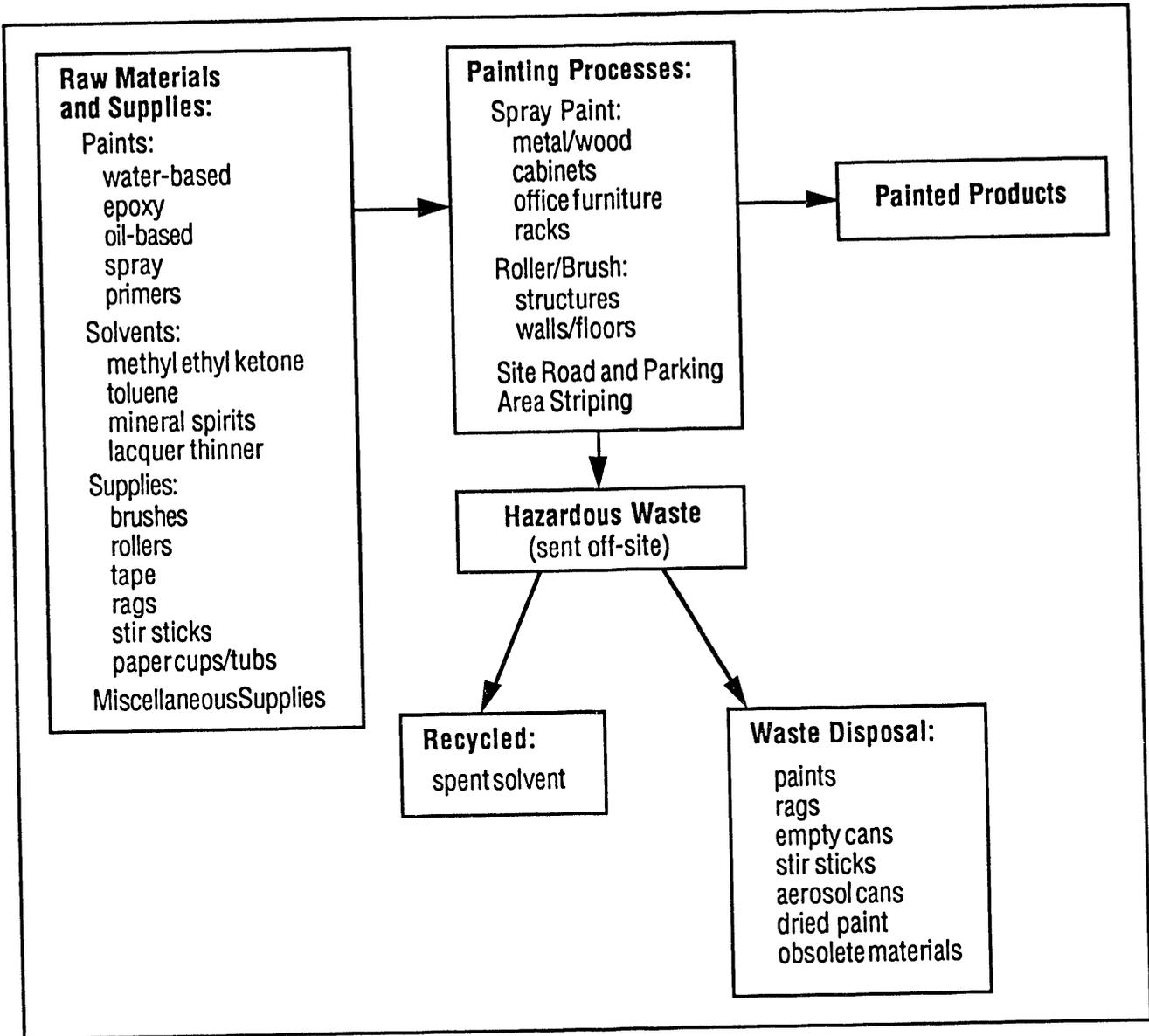


Figure 2. Paint Shop Area Process Flow Diagram.

deflectors. Paint over-spray is removed from the exhaust as it sticks to the surface of the deflectors. The exhaust from the pit is combined with the exhaust coming down from the flow-through filters at the end of the room. It is then routed outside the building, up through the exhaust tower. The deflectors in the pit are scraped down approximately every six months. The dried waste paint from the scrape-down is disposed of as hazardous waste. The pit grate is sent off-site to Lawrence Livermore National Laboratory (LLNL) and sandblasted clean at the same time as the deflectors are cleaned.⁶

All spray painting operations are done over the exhaust pit grate to assure that the over-spray is drawn down into the deflector/over-spray collector system.

The doors to the booth are interlocked with the air supply to the spray guns so that spraying cannot be done until the doors are closed and the exhaust system is working. This feature assures that a full flow of air is going through the room and filters before any paint mists are generated.

The booth is regulated by the BAAQMD, which has issued an air emissions source permit. The Environmental Protection Department informs shop personnel of any changes to regulations (primarily BAAQMD-enforced) that pertain to their operations. BAAQMD Regulation 8, Rules 3, 4, 11, 14, 19, 23, 26, 29, 31, 32, 43, 45, 48, and 49 specifically apply to coating operations.⁷ The shop personnel are required to maintain a detailed inventory and a log of solvents and paints used in the paint booth. The Environmental Protection Department summarizes the records quarterly. The paint and solvent usage data is reported to the BAAQMD annually.^{4,7,8}

Based on the current regulations for the maximum allowable volatile organic compound (VOC) content of the paints used, the shop has eliminated approximately 60% of the paints used in the booth.^{5,6} Paints outside the allowable limits were disposed of in March 1992 and January 1993. A total of approximately 253 gallons of waste paint were generated. Disposal (excluding labor and administration charges) of this paint cost approximately \$2,785. If the booth had had approved emissions abatement equipment, the Paint Shop may not have been required to eliminate all of these paints. However, the shop does not use a large enough volume of paint to justify the capital and maintenance costs of abatement equipment.⁸

Figure 3 shows a flow diagram for the spray painting process.

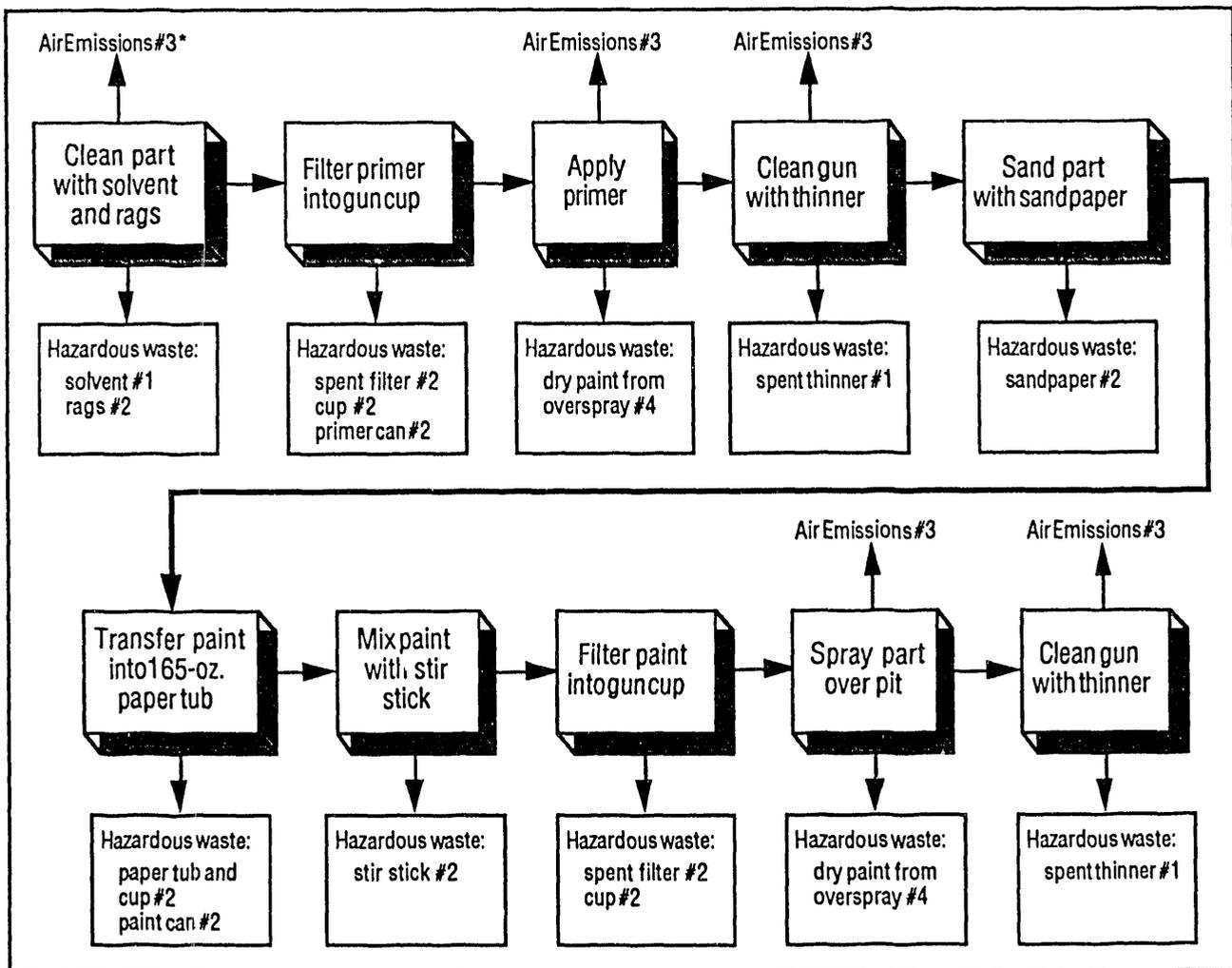


Figure 3. Spray Paint Process Flow Diagram.

*These numbers correspond to Table 2, Material Balance.

Table 1. Paint Shop Hazardous Waste Generation (1/1/92-1/22/93).⁹

Waste Stream	Waste ID	Volume Generated	Cost of Disposal
Solvents/Thinners	MEK/toluene/alcohol	30 gal.	\$120/55-gal. drum
	MEK/toluene/naphtha	29 gal.	
	MEK/lacquer thinner	10 gal.	
	mineral spirits	17 gal.	
	petroleum distillate	31 gal.	
		Total = 117 gal.	Total = \$257
Paint Shop Waste	paint cans/rags/sticks	1191 lbs.	\$950/55-gal. drum + \$85 transportation Total = \$4527
Empty Containers	empty cans/buckets	954 lbs.*	\$950/55-gal. drum + \$85 transportation Total = \$3625
Aerosol Cans	aerosol cans	71 each	\$600/55-gal. drum Total = \$213
Paints	waste paint	31 gal.	\$600/55-gal. drum
	latex	44 gal.	
	oil base	7 gal.	
	enamel	87 gal.	
	water base	2 gal.	
	lacquer	40 gal.	
	polyurethane	12 gal.	
	epoxy/curing agent	30 gal.	
		Total = 253 gal.*	Total = \$2785
Miscellaneous	nitrogen phosphate	2 gal.	Total = minimal
	oil-based colorant	36 lbs.	
	dried paint	8 lbs.	

*The major portion of this volume was generated in the March 1992 and January 1993 clean outs of BAAQMD-regulated VOCs.

The brush and roller operations usually are done outside the Paint Shop. These operations include painting of facility walls, floors, and other structures. Water-based paints are used on most wall surfaces. However, a two-part epoxy-based paint is used occasionally on walls and floors that require durability and resistance to chemicals.⁶

Waste Generation

Table 1 lists hazardous wastes generated by the Paint Shop from Jan. 1, 1992, to Jan. 22, 1993.⁹

In March 1992, Paint Shop personnel requested Environmental Protection personnel to dispose of paints and materials that were above the VOC limits specified by the BAAQMD. This disposal generated approximately 218 gallons of hazardous paint waste and a number of empty paint cans (because the paint was combined into four 55-gallon drums for disposal). The cost to dispose of the

four drums of waste paint was \$2,400. It was this high because the waste had to be sent off-site for destructive incineration. Another 35 gallons of paint above regulatory VOC limits were disposed of in January 1993, as hazardous waste at a cost of approximately \$385. This waste stream was generated to bring Sandia into compliance with government regulations; it is not routine. However, it contributed a significant volume of hazardous waste to SNL/California's overall waste stream in 1992-93 and cost a total of approximately \$2,785.

The primary hazardous waste streams generated routinely in the Paint Shop are:

- waste solvents and thinners;
- "Paint Shop waste"—a combination of paint cans, rags, sticks, filters, and paper containers; and
- aerosol cans.

Waste solvents and thinners are generated during the clean-up of the spray guns and equipment. The waste solvent is collected in a 5-gallon safety can and transferred to a 55-gallon drum. The shop generates only about two 55-gallon drums of solvent waste per year. Reclaiming this small volume of solvent on-site would not be cost effective; therefore, it is sent off-site for reclaiming.

"Paint Shop waste" is a combination of paint cans, rags, sticks, filters, and paper containers contaminated with paint. It is generated during painting processes. These items are compacted in 55-gallon drums and disposed of as solid hazardous waste. By volume, this is the largest and most expensive waste stream routinely generated in the Paint Shop. The total cost to dispose of solid wastes in 1992 was approximately \$4,527.

Used aerosol cans are disposed of as hazardous waste.

Paint Shop personnel have taken steps to minimize other waste streams where possible. For example:

- Throw-away brushes and rollers are used with paint that requires solvent for clean up.
- Brushes, rollers, and buckets used with water-based paint are washed clean with water and reused.
- Paper cups and tubs are used for transferring and mixing spray paints, which eliminates the need for solvent cleanup.
- Wooden stir sticks are wiped off and reused as many times as possible.

Overall, the shop personnel are very aware of the need to minimize hazardous wastes and are continuously looking for opportunities to do so.^{5,6}

Material Balance

The spray paint process requires a number of steps for preparing, priming, and painting an object. Therefore, it is the best paint process for which to create a process flow diagram (Fig. 3) and on which to perform a material balance (Table 2). The data used for this material balance came from the Environmental Protection Hazardous Waste Container Logs and from the Paint Shop records summary reported to the BAAQMD. The average annual air emission data were taken from the *BAAQMD Emissions Data Report*.⁴

Table 2. Material Balance for Spray Paint Process.

Hazardous Waste Stream ID	Input Material ID	Input Volume	Hazardous Waste ID	Volume Generated/Out
Solvents/Thinners #1*	lacquer thinner MEK	19 gal./yr. 12 gal./yr.	MEK/lacquer thinner	5 gal./yr.
Paint Shop Waste #2	paint cans/rags/sticks paper cups/paper tubs/ filters/sandpaper	625 lbs./yr.**	"Paint Shop Waste"	625 lbs./yr.**
Air Emissions #3	paint solvents/ lacquer thinner	31 gal./yr.	air emissions	1 lb./day***
Miscellaneous #4	paint/primer	45 gal./yr.	dried paint	8-10 lbs./yr.

*See Figure 3, Process Flow.

**Estimated volume from spray process.

***BAAQMD average annual emissions data.⁴

Recommendations

The largest routinely generated hazardous waste stream in the Paint Shop is the "Paint Shop waste." Paint Shop personnel should evaluate the possibilities of minimizing the volume of this waste stream or eliminating some of the sources.

A recommendation was made to replace aerosol cans with reusable air-powered spray cans. However, the Paint Shop personnel have tried to use these cans and have found that they generate a significant volume of waste solvents during clean up. Also, they now use aerosol spray cans that meet the BAAQMD's VOC requirements.

Paint Shop personnel should work closely with Environmental Protection personnel to maintain updated information on BAAQMD rules and regulations. The paint inventory should be controlled and documented better to minimize paint volume, to control costs, and to reduce waste sources. Implementation of the new Chemical Inventory System will aid in inventory control. Also, before purchasing new paints, Paint Shop personnel should refer to BAAQMD regulations to make sure the new paints are within current emission limits.

Paint Shop personnel should evaluate opportunities for substituting less hazardous solvents for solvents used now.

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