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**PROCESS WASTE ASSESSMENT
FOR THE
PLOTING AND DIGITIZING SUPPORT LABORATORY**

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ABSTRACT

This Process Waste Assessment was conducted to evaluate the Plotting and Digitizing Support Laboratory, located in Building 913, Room 157. It documents the processes, identifies the hazardous chemical waste streams generated by these processes, recommends possible ways to minimize waste, and serves as a reference for future assessments of this facility.

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PROCESS WASTE ASSESSMENT

PLOTTING AND DIGITIZING SUPPORT LABORATORY

Introduction

The 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 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, Sandia conducts process waste assessments (PWAs) to identify waste generating processes. The information collected from a PWA is then used to identify waste minimization opportunities.

This PWA was conducted on the Plotting and Digitizing Support Laboratory, according to Sandia's revised *Process Waste Assessment Plan*.³ This PWA documents the processes, identifies the waste streams, and serves as a reference for future assessments of this facility.

Summary

The Plotting and Digitizing Support Laboratory is located in Building 913, Room 157. It provides photo-circuit masters to various site projects.

The laboratory's major equipment comprises a Gerber Photo Plotter and an AGFA Rapidline 66 Film Processor. The process begins with a customer design of a photo-circuit master. The customer requests the laboratory support personnel to process it onto film. The photo plotter exposes the master onto film, and the film processor develops the film. The lab personnel then return the finished photo-circuit master to the customer.

In this process, the AGFA Film Processor generates most of the hazardous waste (spent developer and fixer). It is a self-contained unit and is fitted with automatic chemical replacement and a rinse water unit. The volume of waste generated by the laboratory (approximately four drums per year of photo chemicals) is low compared to other photo processing labs. However, water use could be minimized further. The AGFA Film Processor's rinse water flows freely to the sewer at a rate of approximately 7,200 to 10,800 gallons annually. If the processor can be fitted with a filtration/recirculation system similar to those installed on the Photo Lab's processors (Building 913, Room 156), its water use will significantly diminish. (The Photo Lab reduced water use by approximately 92% using filtration/recirculation systems.)

Process Waste Assessment

Facility

The Plotting and Digitizing Support Laboratory, Building 913, Room 157.

Products

Photo-circuit masters.

Background

In 1992, the Plotting and Digitizing Support Laboratory moved from Room 108 to Room 157. This move disrupted operation for approximately one month. As a result, the historical data on hazardous waste generation is limited to what has been generated since the beginning of 1993. Therefore, this PWA primarily documents the processes, identifies the waste streams, and serves as a reference for future assessments.

Process Description

The Plotting and Digitizing Support Laboratory provides photo-circuit masters to various SNL/California projects. It is located in Building 913, Rooms 157A and B. Room 157 is divided into five areas, Rooms A–D and an office area. Rooms 157C and D are used by the Stereo Lithography Laboratory and are not included in this PWA. Figure 1 shows the layout of Room 157.

The process in the Plotting and Digitizing Support Laboratory begins with a customer's design of a photo-circuit master. The customer then requests the lab personnel to process it

Figure 1. Layout of the Plotting and Digitizing Support Laboratory.

onto film. The lab personnel first process the film through the laser photo plotter, where the circuit is exposed onto the film. They then develop the film in an AGFA Rapidline 66 Film Processor. The finished photo-circuit master is returned to the customer.⁴

The AGFA Rapidline 66 Film Processor generates most of the lab's hazardous waste. This processor is self-contained and is fitted with tanks, an automatic chemical replenisher, and a rinse-water unit.

The chemicals in the processor tanks are monitored daily. Five gallons of developer replenisher are added weekly. The fixer replenisher is replaced every two weeks. Also, the baths are drained, and fresh chemicals are added biweekly.

The processor sits in secondary containment, which is large enough to hold a spill greater than the volume of any of the tanks or other containers. Overflow from the processor tanks is collected in five-gallon plastic containers.

As required by regulations, no chemicals are poured down the lab drains, which are connected to the sewer system. The only exception is small amounts of chemicals adhering to the processor racks, empty tanks, funnels, and other removal parts, which are rinsed in the sink during cleaning.⁵ If an accident does occur and hazardous chemicals are discharged to the drain, the Environmental Protection Department is notified immediately.

Rinsing Operations

Rinse water flows freely through the processor to the sewer. The volume of effluent discharged to the sewer annually is approximately 7,200–10,800 gallons.

Cleaning Operations

The laboratory personnel drain and clean the processor biweekly. An outside contractor completes preventive maintenance on the processor quarterly.

Process Flow and Material Balance

Figure 2 is a general process flow diagram for the facility. Because the AGFA Rapidline 66 Film Processor generates the largest amount, by weight, of the hazardous waste (spent fixer and developer) generated by the lab, a material balance for the process is shown in Fig. 3, and its process flow is shown in Fig. 4 (the chemical compositions are listed in Table 1). Estimated values are based on process knowledge and the operator's experience with the process.

Waste Generation

The Plotting and Digitizing Support Laboratory generates a relatively low volume of hazardous waste annually (approximately four drums of photo chemicals). The AGFA Rapidline 66 Film Processor generates most of the waste, which is spent fixer and developer, and overflow chemicals from the automatic adjustment of the baths.

Table 2 contains the laboratory's waste generation data.

Figure 2. Plotting and Digitizing Support Laboratory Area Process Flow Diagram.

Figure 3. AGFA Rapidline 66 Film Processor Material Balance.

Figure 4. AGFA Rapidline 66 Film Processor Process Flow.

Table 1. AGFA Rapidline 66 Film Processor Working Bath Chemistry.

Type of Bath and I.D.	Chemical Composition of Working Bath ^{6,7}	Weight (%)	Volume of Bath (L)	pH
1. Kodak Ultratec Developer and Replenisher	Water Tripotassium phosphate Sodium sulfide Hydroquinone Sodium hydroxide	80–85 5–10 5–10 3 1–5	19	11.4
2. Kodak Ultratec Fixer and Replenisher	Water Ammonium thiosulfate Sodium acetate Boric acid	40–50 40–50 5–10 <5	19	5.0
3. Rinse	City Water	100	19	—

Table 2. Plotting and Digitizing Support Laboratory Hazardous Waste Generation (January 1993 to November 1993).⁸

Waste Stream	Waste I.D.	Volume Generated (kg)	Cost of Disposal*
Developer	Developer	666	\$150/55-gal. drum Total = approx. \$444
Fixer	Fixer	210	\$200/55-gal. drum Total = approx. \$186
Wipes/Filters	Developer Wipes Developer Filters	2 6.5 Total = 8.5	\$950/55-gal. drum + \$85 transportation Total = approx. \$97
	Total	884.5	Total = approx. \$727

* Includes only disposal and transportation costs. Does not include administrative or handling charges.

The Environmental Protection Department commingles spent fixer from this laboratory and the Photo Lab (Building 913, Room 156). These fixers contain silver, which is reclaimed by an outside contractor. Silver recycling reduces the cost of disposal. On-site silver reclamation has been evaluated, but because of the small amount of silver generated, it would not be cost effective.

Recommendations

Although this facility generates a relatively low volume of hazardous waste annually, some waste minimization opportunities merit evaluation:

- The volume of water used in the rinsing operation (and hence, the volume of effluent going to the sewer) could be reduced by an estimated 80–90%, if the laboratory installed a rinse-water recirculation/filtration system. The Photo Lab (Building 913, Room 156) installed such a system on their processor units and reduced water use by about 92%. The cost of a recirculation system ranges from \$600 to \$1,000.⁹
- If feasible, the laboratory personnel should evaluate extending the amount of time between chemical bath replacement.

References

1. U.S. Department of Energy (DOE), Order 5400.1, *General Environmental Protection Program* (November 9, 1988).
2. U.S. DOE, Order 5400.3, *Hazardous and Radioactive Mixed Waste Program* (February 22, 1989).
3. U.S. DOE, SNL/California, *Process Waste Assessment Plan*, PD457712 Issue A (June 1993).
4. Wackerly, Carl, 1993, Sandia Plotting and Digitizing Support Laboratory, personal communication with N. M. Phillips.
5. U.S. DOE, SNL/California, *Changing and Disposing of Chemicals in the AGFA Rapidline 66 Film Processor*, OP471068 Issue B (June 17, 1993).
6. Eastman Kodak Company, *Kodak Ultratec Developer and Replenisher*, MSDS Accession Number 448046 (January 4, 1990).
7. Eastman Kodak Company, *Kodak Ultratec Fixer and Replenisher*, MSDS Accession Number 427810 (October 29, 1987).
8. U.S. DOE, SNL/California, *Environmental Protection Hazardous Waste Storage Log* (1993).
9. Chin, Cary, 1993, Sandia Photography Laboratory, personal communication with N. M. Phillips.

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