POLLUTION PREVENTION OPPORTUNITY ASSESSMENT

General Mail and Vehicle Maintenance Facility

United States Postal Service

Buffalo, NY

September 1992

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PREFACE

This document presents the results of a Pollution Prevention Opportunity Assessment conducted at the U.S. Postal Service's (USPS) General Mail Facility (GMF) and Vehicle Maintenance Facility (VMF) in Buffalo, New York. The assessment was conducted for the Environmental Protection Agency - Region II and the USPS - Northeast Region to investigate potential pollution prevention alternatives for GMF mail processing operations and VMF vehicle servicing and refinishing operations.

In particular, this document identifies and discusses the economic and technical feasibility of potential source reduction and recycling opportunities, and presents a limited implementation plan. Discussion of potential barriers to implementing the identified options and recommendations for future investigations into techniques to eliminate, reduce, or recycle wastes from mail processing and vehicle maintenance operations is also incorporated.

It should be noted that although USPS facilities were the subject of the assessment, the alternatives presented also apply to commercial package handling operations, as well as other government and commercial vehicle servicing facilities.

PROJECT SUMMARY
POLLUTION PREVENTION OPPORTUNITY ASSESSMENT
General Mail and Vehicle Maintenance Facility
United States Postal Service
Buffalo, NY

by
Science Applications International Corporation
Falls Church, VA 22043
Cincinnati, OH 45203

September 1992

EPA Contract No. 68-C8-0062
SAIC Project No. 01-0832-03-1006-010

ABSTRACT

This report presents the results of a Pollution Prevention Opportunity Assessment (PPOA) conducted at the U.S. Postal Service's (USPS's) General Mail Facility (GMF) in Buffalo, New York. The PPOA was conducted of operations at the GMF (where mail is processed) and at the Vehicle Maintenance Facility (VMF) (where 1,200 postal vehicles are serviced and refinished). Waste generation at both facilities was documented and quantified. The reports identified potential source reduction and recycling initiatives as well as areas where further research is needed. The economic and technical feasibility of selected opportunities and techniques to eliminate, reduce, or recycle wastes were investigated. A limited implementation plan was developed. Potential barriers to implementing the identified options are described.

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INTRODUCTION

The Environmental Protection Agency (EPA) Region II has established a Regional policy to actively pursue pollution prevention at Federal facilities. The United States Postal Service (USPS) is committed to source reduction and recycling as sound environmental practices. The USPS's goal is to reduce waste 25 percent (from 1992 levels) by December 1993 and an additional 25 percent by December 1995. Moreover, the USPS is committed to reducing the use of 17 hazardous chemicals identified by EPA's 33/50 Program over the next 3 years.

In response to its outreach efforts, EPA Region II received a request from the USPS for technical assistance. A pollution prevention opportunity assessment was carried out of the GMF and the VMF operations at the Buffalo, New York, facility to identify source reduction and recycling options for both hazardous and nonhazardous wastes. This particular demonstration project is intended to serve as a model for establishing pollution prevention programs at other Postal Service facilities in the Northeast region, and potentially, in other parts of the country as well. The results of the GMF and VMF assessments are described separately in two companion reports Pollution Prevention Opportunity Assessment General Mail Facility, and Pollution Prevention Opportunity Assessment Vehicle Maintenance Facility.

PROCEDURE

The assessment was conducted using the procedures outlined in EPA's Facility Pollution Prevention Guide (EPA/600/R-92/088). The assessment has two major phases. The first phase quantifies current waste generation and management practices. The second phase identifies and evaluates the feasibility of opportunities and techniques to eliminate, reduce, or recycle wastes. The project includes:

- Selecting assessment targets;
- Assessing onsite pollution prevention capabilities;
- Generating pollution prevention options;
- Preparing a feasibility analysis of selected options;
- Preparing a limited implementation plan.

The PPOA Team that conducted the assessment was composed of employees from an outside environmental consulting firm and USPS representatives.

RESULTS AND DISCUSSION

General Mail Facility

The Buffalo GMF processes 5 million pieces of mail a day. Three areas are responsible for generating the majority of the facility's wastes: the offices, the mail sorting floor, and the unloading and loading docks. The GMF generates approximately 537 tons of waste per year. Approximately 253 tons is cardboard. Major waste streams are shown in Table 1. Machinery maintenance wastes (oil, grease, and parts cleaning solvent) are also generated. The composition of much of the waste is undetermined. Direct observation of the waste compactor contents was not possible due to safety concerns. The "missing" tonnage may include corrugated plastic containers, pallets, aluminum, or metals improperly discarded instead of recycled. Furthermore, disposal of many materials, such as pallets, plastic film, and corrugated cardboard, at the Buffalo facility is not easily monitored and may have been underestimated. Annual solid waste disposal costs are approximately $42,000.

TABLE 1. ESTIMATED SOLID WASTE GENERATION USPS BUFFALO GENERAL MAIL FACILITY, 1991-1992

WASTE STREAM	QUANTITY
Cardboard	253.5 tons
Computer Paper	2 tons
Mixed Office Paper	46 tons
Aluminum Cans	0.6 tons
Other Metals	30 tons
Plastic Film	13 tons
Undetermined	191.9 tons

The major recommended source reduction and recycling options are shown below. Discussions for each of the options are included in the GMF report.

- Establishing recycling programs for each waste stream;
- Reducing packaging;
- Establishing a duplex copying policy;
- Improved waste management cost accounting;
- Improved employee involvement in pollution prevention;
- Changing procurement specifications.

Vehicle Maintenance Facility

The Buffalo VMF operations include vehicle maintenance and automotive refinishing operations typical of facilities of its kind. The Buffalo USPS fleet includes 1,200 vehicles such as passenger cars, trucks, and semi-tractor trailers. Major waste streams generated from this facility are shown in Table 2. Waste disposal costs are approximately $21,645 annually.

TABLE 2. ESTIMATED WASTE GENERATION
USPS BUFFALO VEHICLE MAINTENANCE FACILITY 1991

WASTE TYPE	ANNUAL QUANTITY
Oil Filters	1,800 filters
Lead Acid Batteries	280 batteries
Brakes	1,200 - 1,500 sets
Cracked Corn Absorbent	30 - 60 gallons
Soiled Rags	8,515 rags
Paint Equipment Cleaning Solvent	1,118 pounds
Waste Paint/Thinner	1,664 pounds
Solvent Brake Cleaner	2,106 pounds
Solvent Engine Parts Cleaner	5,746 pounds
Used Oil (engine, brake fluid, transmission fluid)	2,830
Used Antifreeze	300 gallons
Radiators	280 radiators

A number of source reduction and recycling options were identified and are discussed in the full report.

Major source reduction and recycling options are:

- Switching to water-borne low volatile organic compounds (VOC) paints;
- Using high volume low pressure (HVLP) spray guns;
- Switching to aqueous cleaners.
- Paint Mixer System
- Gun Washer Station
- Operator Training

The economic feasibility of selected options is shown in Table 3.

TABLE 3. COST/BENEFIT ANALYSIS FOR SELECTED OPTIONS

OPTION	
HVLP Paint Application System	
Total Annual Avoided Costs	$11,196
Net Annual Benefit	$8,138
Pay Back Period	Immediate
Gun Washer Station	
Total Annual Avoided Costs	$8,567
Net Annual Benefit	$3,000
Pay Back Period	Immediate

CONCLUSIONS AND RECOMMENDATIONS

Postal service employees have enacted a number of activities to reduce or recycle VMF and GMF wastes. There are additional pollution prevention opportunities, identified in the reports, to further eliminate or reduce wastes. Painting operation and engine and brake parts washing are the biggest pollution prevention opportunities at the VMF. Water borne coatings and high transfer efficiency paint delivery systems will eliminate or significantly reduce hazardous wastes and VOC emissions from painting operations. Replacing organic cleaning solvents with aqueous parts washers and chemicals will eliminate hazardous solvent wastes from engine and brake parts washing operations. Enacting these options can potentially reduce annual hazardous waste generation by 5,954 pounds.

Implementing options recommended in the two reports will assist the Buffalo facility staff meet the USPS goal to reduce 1992 waste levels by 25 percent by 1993 and an additional 25 percent by 1995. Eliminating solvent borne paints will significantly reduce emissions of four EPA 33/50 target chemicals generated during painting operations at the VMF. The options identified in the report will also reduce operating costs by decreasing disposal costs. By implementing the options described in the two report the USPS has the potential to save over $100,000 on waste disposal costs as shown in Tables 4 and 5. Additionally, there are unquantified benefits such as reduced liability, paper work, spills and spill control/disposal costs, and future regulatory requirements. Potential barriers to implementing pollution prevention options are discussed in the full reports. Overall, there are no major barriers to implementing many of the pollution prevention options. The options identified in the two reports are generally applicable to the 350 vehicle maintenance and 270 general mail facilities nationwide.

TABLE 4. ESTIMATED ANNUAL RETURN FROM SOURCE REDUCTION AND RECYCLING USPS GENERAL MAIL FACILITY, BUFFALO, NY

ACTION	POTENTIAL MONETARY BENEFIT
Current Practices	
Recycle laser printer cartridges	$1,740
Recycle aluminum cans	$1,011
Recycle scrap metal	$2,125
Recycle loose cardboard (2)	$34,000
Subtotal (current practices)	$38,876
Additional Recommended Measures	
Recycle plastic film	$5,485
Subtotal (recommended measures)	$5,485
Recently Implemented or Proposed	
Recycle computer paper	$240
Recycle mixed office paper	$1,955
Replace paper hand towels with electric air dryers (3)	$50,000
Subtotal	$52,195
Total	$96,556

Notes:

1. Monetary benefits include a $85 per ton avoided disposal cost and payment for recyclable materials (aluminum, plastic film, and computer paper). Disposal costs for other locations may differ significantly from this value. Payment for recyclable materials is based on the September 1992 market in the Buffalo area. Any use of these numbers must recognize the fact that markets for recyclable materials vary greatly with time and location.
2. Cardboard recycling commenced as a result of the preliminary assessment findings.
3. Includes replacing hand towels at Buffalo GMF and Station Branches.

TABLE 5. POTENTIAL WASTE REDUCTION AND COST SAVINGS FOR SELECTED OPTIONS USPS, BUFFALO VEHICLE MAINTENANCE FACILITY

Option	Annual Waste Reduction Potential	Annual Cost Saving Potential
Water Borne Paints	2,782 lbs of hazardous waste paint/solvent/thinner	$3,088 in reduced waste disposal
Aqueous Parts Washer	3,163 lbs of hazardous engine and brake parts cleaning solvent	Undetermined
HVLP Paint Application System	50% less VOC emissions 30% less paint solid waste	$8,138 in reduced raw material and waste disposal
Gun Washer Station	75-90% less VOC emissions	$2,978 in reduced raw materials and waste disposal

POLLUTION PREVENTION OPPORTUNITY ASSESSMENT

GENERAL MAIL FACILITY

United States Postal Service Facility, Buffalo, NY

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Science Applications International Corporation
Falls Church, VA
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DISCLAIMER

The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under Contract 68-C8-0062 to Science Applications International Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document.

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ABSTRACT

This report presents the source reduction and recycling recommendations resulting from a pollution prevention assessment conducted at the Postal Service General Mail Facility in Buffalo, New York. The assessment was performed under Work Assignment 3-54 entitled U.S. Postal Service Operations Pollution Prevention Opportunity Assessment for the U.S. EPA Region II and the United States Postal Service (USPS).

The assessment, conducted during the week of April 6, 1992, followed procedures in the U.S. EPA Waste Minimization Opportunity Assessment Manual (EPA\625\7-88\003) and the United State Postal Service Recycling Guide and Waste Reduction Guide. These procedures encompass the concepts contained in the U.S. EPA Facility Pollution Prevention Guide (EPA/600/R-92/088). Technologies and techniques to reduce and recycle wastes were evaluated for effectiveness. This report identifies potential solid waste reduction and recycling initiatives and identifies areas where further research is needed.

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ACKNOWLEDGEMENTS

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INTRODUCTION

Background

The Environmental Protection Agency (EPA) Region II has established a regional policy to actively pursue pollution prevention at federal facilities. In response to EPA Region II outreach efforts, the Postal Service Northeast Region requested technical assistance to explore ways to reduce the amount of waste generated at the general mail facility (GMF) located in Buffalo, New York. This assessment was conducted in response to the United States Postal Service (USPS) policy to practically reduce the amount of waste generated at its facilities. The Postal Service is committed to source reduction and recycling as sound environmental practices. USPS policy is to reduce waste and pollutants at the source of generation. Following source reduction, postal priorities for solid and liquid nonhazardous and hazardous waste management are recycling, energy conservation and recovery, waste treatment, and (as a last resort) waste disposal (USPS Waste Reduction Guide, AS 552). The Postal Service's goal is to reduce the amount of waste generated in 1992 by 25 percent by December 1993 and an additional 25 percent by December 1995. A detailed explanation of pollution prevention and its benefits is discussed later in the report. The Postal Service and EPA are interested in using the findings of this study as a model for Postal Service facilities in the Northeast region and potentially for mail facilities in other parts of the country as well.

The project was initiated in January, 1992. The assessment team, comprised of SAIC staff, conducted the onsite assessment of the Buffalo facility in March. An initial briefing was held to acquaint Postal Service officials with the assessment team members, discuss objectives of the site visit, and organize the onsite information gathering process. In addition, the assessment team gave a half day presentation to Postal Service and EPA representatives from the Northeast region. The presentation covered pollution prevention concepts, waste management issues of concern to the Postal Service, an overview of the pollution prevention opportunity assessment process, and overall project goals. The assessment team spent three days at the Buffalo facility and viewed the areas where wastes are generated; collected process information; interviewed facility personnel; identified waste management procedures; identified procurement procedures; gathered information concerning waste generation, disposal methods, and costs; and local waste handling/reduction programs. A color slide log of the assessment and accompanying text was prepared.

The assessment team continued to collect information by phone after the site visit. The assessment team identified the most significant waste streams based on the quantity of waste generated, the chemical constituents, and associated disposal costs. SAIC analyzed each process that generated a significant waste. Analysts then identified and evaluated options for waste reduction for each process found at the Buffalo facility using the Worksheets completed during the site assessment (see Appendix A). In addition, team members explored several options that could also apply to other Postal Service facilities.

Purpose

The purpose of this project is to conduct a pollution prevention opportunity assessment to identify source reduction and recycling options for both hazardous and nonhazardous wastes at the Buffalo GMF. An opportunity assessment has four phases; a planning and organization phase, an assessment phase, a feasibility analysis phase, and an implementation phase. During the planning and organization phase, management commitment is secured, overall assessment goals are set, and the assessment program task force is organized. The assessment phase involves quantifying current waste generation and management practices. This involves prioritizing and selecting assessment targets, collecting process and facility data, selecting the assessment team members, reviewing data, generating options, and screening and selecting options for further study. The feasibility analysis phase is a technical and economic evaluation of the selected options which are ranked and chosen for implementation. The implementation phase puts the options into action. This may require justifying projects and obtaining funding, installing equipment, implementing procedures, and evaluating the performance of each option.

This report summarizes the results of the pollution prevention opportunity assessment and explains specific options and their associated costs and benefits. The Postal Service can use this report as the basis for its pollution prevention implementation plan. Both source reduction and recycling alternatives have been considered for the selected waste streams.

The assessment covered both the GMF and the vehicle maintenance facility (VMF) which are located at the Buffalo Postal Service site. The findings for each of these facilities are reported separately. This report presents the findings from the assessment of the GMF.

Site Description

The USPS GMF, located at 1200 William Street, Buffalo, New York, is situated on a site of approximately 25 acres. A separate building housing the VMF is also located on the property. Both facilities were designed and built to USPS specifications. The USPS leased the site beginning in 1963 and purchased it in 1979.

The Buffalo GMF is owned by the USPS. The GMF consists of a three story office building and a one story, 276,000 square foot mail processing floor. On the east and west sides of the building are docks, each with more than fifty truck positions. A leased, single story building at 1285 William Street, several blocks away, houses the Computerized Forwarding System and the Undeliverable Bulk Business Mail (UBBM) operation. The Buffalo GMF is occupied 24 hours a day, seven days a week, 365 days a year. Normal employee occupancy on weekdays is 1,515; Saturdays, 1,082; and Sundays and holidays, 688. During the month of December, approximately 200 additional temporary employees are on site. There are 118 office and supervisory employees and 10 individuals responsible for building maintenance.

Nearly 2 million pieces of mail, including first and third class letters and flats, arrive for processing at the GMF each day, while approximately 3 million pieces of mail are sent out of the GMF for delivery to recipients. The Buffalo GMF serves as the Area Distribution Center for zip code areas 140-149; the State Distribution Center for third class letters and flats for zip codes areas 130-149; the Mail Processing Center for all 17 stations and branches in Buffalo; and the Sectional Center Facility for 104 Associate Offices. The GMF serves as Parcel Post Distribution Center for zip code areas 130-149; parcel post daily volume averages about 24,000 pieces.

In addition, all mail from the eastern seaboard destined for Canada is routed through the Buffalo GMF. As a major entry point to and from Canada, Buffalo GMF provides space in the lobby and on the workroom floor to U.S. Customs and serves as a concentration center for mail transportation equipment.

PURPOSE AND BENEFITS OF POLLUTION PREVENTION

Prior to developing and implementing a pollution prevention program, it is imperative that a facility fully understand pollution prevention and its components. The following sections describe the goals, concept, and benefits of pollution prevention and the procedure for conducting an opportunity assessment similar to those conducted under this project. The USPS has a series of pollution prevention related guides: Waste Reduction Guide (AS 552), Recycling Guide (AS 550), Stormwater Management Program Guide, and Hazardous Waste Guide (AS 553). These USPS guides contain step by step assessment procedures, suggested pollution prevention best management practices and technologies, and helpful worksheets. They also explain USPS pollution prevention policies and waste reduction goals. A comprehensive USPS facility pollution prevention program will incorporate the policies, plans and programs contained in these USPS documents.

Pollution Prevention - Goals

The ultimate goal of pollution prevention is to reduce present and future threats to human health and the environment. Pollution prevention is any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and any practice which reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants (Pollution Prevention Act of 1990). Pollution prevention is a fundamental shift from treatment of wastes. Source reduction does not include any practice which alters the physical, chemical or biological characteristics of the volume of a hazardous substances, pollutant, or contaminant through a process or activity which itself is not integral to and necessary for the production of a product or the providing of a service.

Pollution prevention is a multimedia approach that minimizes or eliminates pollutants released to land, air, and/or water without simply shifting pollutants from one media to another. Pollution prevention is accomplished by equipment or technology modifications; process or procedure modifications; reformulation or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control.

Pollution prevention is the environmentally preferable option in the waste management hierarchy. Pollutants that cannot be prevented should be recycled in an environmentally safe manner. Pollutants that cannot be prevented or recycled should be treated in an environmentally safe manner. Disposal or other release into the environment should be utilized only as a last resort and should be undertaken in an environmentally safe manner.

Recycling is using, reusing, or reclaiming materials/waste, including processes that regenerate a material or recover a usable product from it (USEPA, Facility Pollution Prevention Guide). There are many ways materials can be reused or reclaimed. Reusing products, such as reusable beverage containers, results in decreased purchases of raw materials and reduces pollutants generated from making new products. Offsite recycling is often affected by exterior influences, such as market prices for recycled products and availability of reclamation technology.

Pollution Prevention - Benefits

Facilities gain both direct and indirect benefits by implementing pollution prevention options as demonstrated in the following benefits defined in the U.S. Postal Service Waste Reduction Guide.

The Postal Service will benefit from waste reduction by:

- Significantly reducing the amount of pollution released to the environment
- Obtaining reductions faster than might be achieved by waiting for statutes or regulations to take effect and by achieving permanent solutions where source reductions occur
- Providing the flexibility to choose cost-effective and environmentally sound solutions that will also result in improved efficiency and net economic growth
- Creating clear expectations in the form of a national goal for targeted chemicals
- Providing positive incentives through public recognition of its efforts and by working to identify regulatory barriers
- Saving capital

- Minimizing paperwork
- Reducing liability
- Possibly changing the status of facilities that generate hazardous waste from Large Quantity Generator to Small Quantity or Very Small Quantity Generator status
- Reducing long-term risks of an uncertain nature and scope–such as the cumulative effects of toxic substances–without waiting for research

The analyses of source reduction and recycling options in this report focus primarily on the direct benefits to the Buffalo facility in savings in disposal, operational, and procurement costs. However, the indirect benefits of pollution prevention may be equally significant. One indirect benefit is reduced liability. The USPS will lower its liability under Research Conservation and Recovery Act's (RCRA's) "cradle to grave" provisions and the provisions of the Federal Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). The RCRA and Superfund "cradle to grave" provisions stipulate that a generator remains responsible for all environmental damage resulting from its waste including damage that occurs after disposal. Even the disposal of small quantities of hazardous wastes to a Superfund site could result in the Institution being responsible for costly future cleanup. Having less hazardous or toxic materials onsite will also mean reduced occupational hazards, and, therefore, improved worker health and safety. Finally, a pollution prevention program can generate good will in the community and workplace, enhance the USPS's public image, and foster environmental awareness among employees. By decreasing the amount of hazardous waste shipped offsite for disposal, the USPS may also reduce the costs associated with tracking and filing paper work required for hazardous waste manifests.

Pollution Prevention Opportunity Assessment Procedure

In general, this project follows the EPA procedures outlined in the Waste Minimization Opportunity Assessment Manual (EPA/625/7-88/003) and is consistent with the concepts contained in EPA's Facility Pollution Prevention Guide and shown in Figure 1. These procedures are consistent with the waste reduction approach contained in the United States Postal Service publications Waste Reduction Guide (AS 552), Stormwater Management Guide, Recycling Guide (AS 550) and Hazardous Waste Guide (AS 553). These USPS guides contain step-by-step assessment procedures, suggested pollution prevention best management practices and technologies, and helpful worksheets. They also explain USPS pollution prevention policies and waste reduction goals.

Pollution prevention opportunity assessments have four phases: 1) planning and organization, 2) assessment, 3) feasibility analysis, and 4) implementation (Figure 1). During the planning and organization phase, a commitment from management is ensured, overall assessment goals are set, and the assessment program task force is organized. The assessment phase involves quantifying current waste generation and management practices, including collecting process and facility data, setting priorities and selecting assessment targets, selecting assessment team members, reviewing data, generating options, and screening and selecting options for further study. The feasibility analysis phase is a technical and economic evaluation of the selected options. Options are ranked and selected for implementation The implementation phase puts the options into action. This may require justifying projects and obtaining funding, installing equipment, implementing procedures, and evaluating the performance of each option. This report covers the first three steps and provides the framework for implementation.

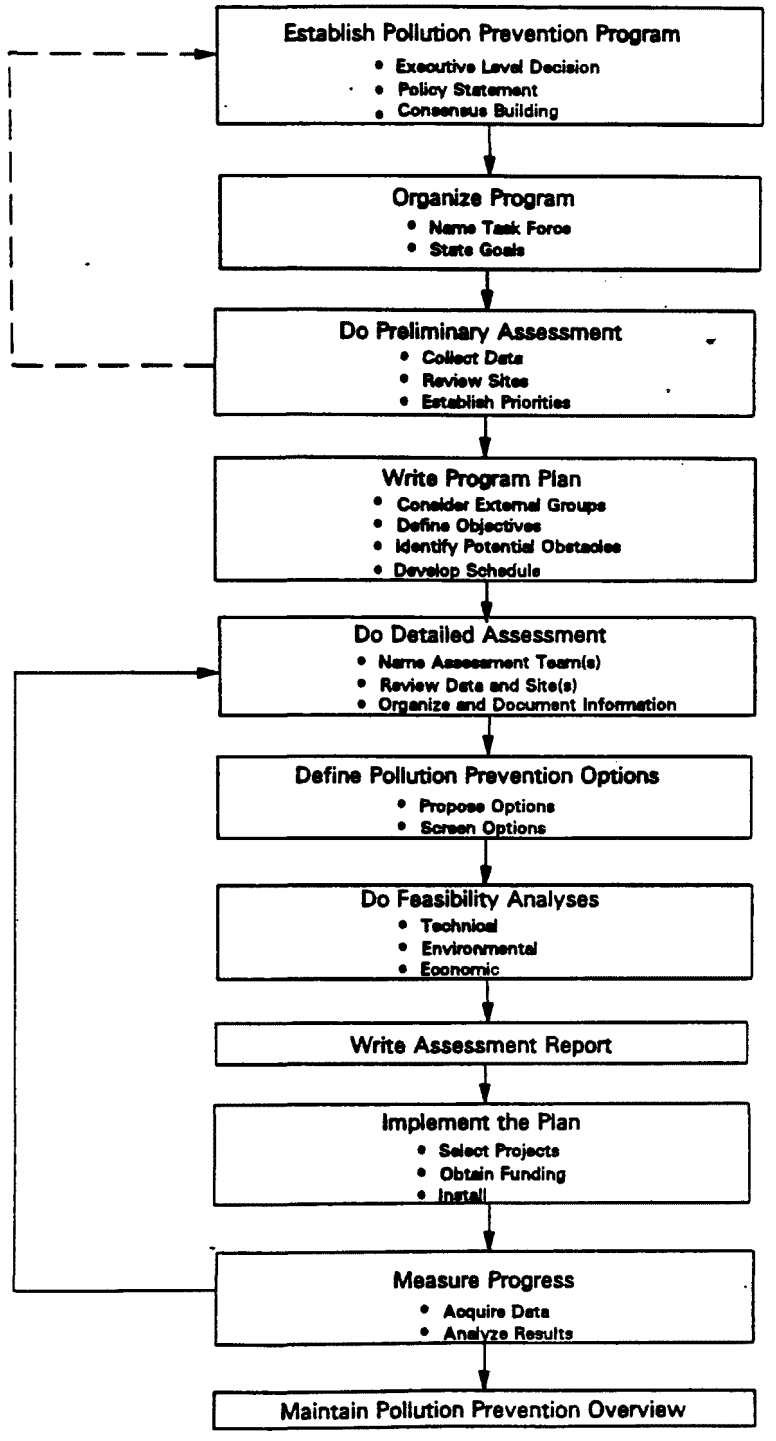


Figure 1. Pollution Prevention Opportunity Assessment Procedure.

WASTE QUANTITIES AND DISPOSAL COSTS

Determining the composition and quantity of waste provides a baseline description of waste type, quantity, and waste management costs. This baseline information is used to identify the major wastes and evaluate source reduction and recycling opportunities. To determine the composition of the waste stream and waste generation rates, the assessment team reviewed purchasing records and private waste hauler payment records, interviewed USPS employees, and made direct observations of waste container contents. Direct observation of the compactor contents was not possible due to access and safety concerns. Waste generation rates and costs are estimates because complete information was not available. The purchasing records and waste hauler bills, although incomplete, were the best source of information on waste quantities and disposal costs. Beyond total waste tonnage, very little data were available to quantify the individual waste streams generated within the GMF.

Waste Generation

Solid waste from GMF operations is collected from individual generation sites and placed into a 40 cubic yard trash compactor. Before September 1992, the compactor was typically emptied (or "pulled") twice weekly by a commercial waste hauler, Downing Container Service, who delivers the waste to the Niagara Energy Complex, a waste to energy incinerator operated by Occidental Chemical. Compactor contents are not monitored, so the contents of each pull has been estimated. One full year of waste hauler bills were examined. The bills indicated that 507 tons of waste were collected from the GMF compactor from September 1991 through August 1992 and the average pull weight during that one-year period was 4.78 tons. Downing charges the USPS $405.20 for each compactor pull, or approximately $85 per ton. The annual charge for the collection and disposal of the GMF waste was approximately $43,000.

In August 1992, the GMF began separating cardboard from the waste stream and collecting it for recycling. Recycling cardboard significantly reduces the waste quantity disposed of in the compactor. Cardboard recycling has only been in place for a short period of time, but the annual quantity of cardboard diverted is estimated to be 253.5 tons. Due to the limited quantity of cardboard collection data available, this is a rough estimate. The actual quantity may be significantly higher.

Scrap metal (20 to 30 tons/year) is collected separately in a 40 cubic yard dumpster. This dumpster is removed once every two weeks at no cost by a private metal refining (smelting) company. Aluminum cans are also collected separately and returned for a refund of $0.05 per can. Aluminum can collection containers are placed throughout the GMF and approximately 1200 pounds (0.6 tons) of aluminum are collected annually.

The components of the GMF waste stream are listed in Table 1. The exact composition and relative contribution of different waste types to the total annual waste stream is unknown. Figure 2 presents estimated waste quantities for the total GMF waste stream (excluding CFS/UBBM and cafeteria). These values are based on review of worksheets completed by USPS employees, interviews with USPS employees, review of waste hauler records, and best professional judgement.

Approximately 253 tons of corrugated cardboard is generated annually. Other major wastes include plastic film such as shrink wrap, stretch wrap and bags (13 tons) and mixed office paper (23 tons). It should be noted that of the 537 tons of waste generated annually, only 345 tons of the waste is identifiable (see Figure 2). The "missing" tonnage may include corrugated plastic containers, pallets, aluminum, or metals improperly discarded instead of recycled. Furthermore, disposal of many materials, such as pallets, plastic film, and corrugated cardboard, at the Buffalo facility is not easily monitored, consequently waste quantities of these materials may have been underestimated.

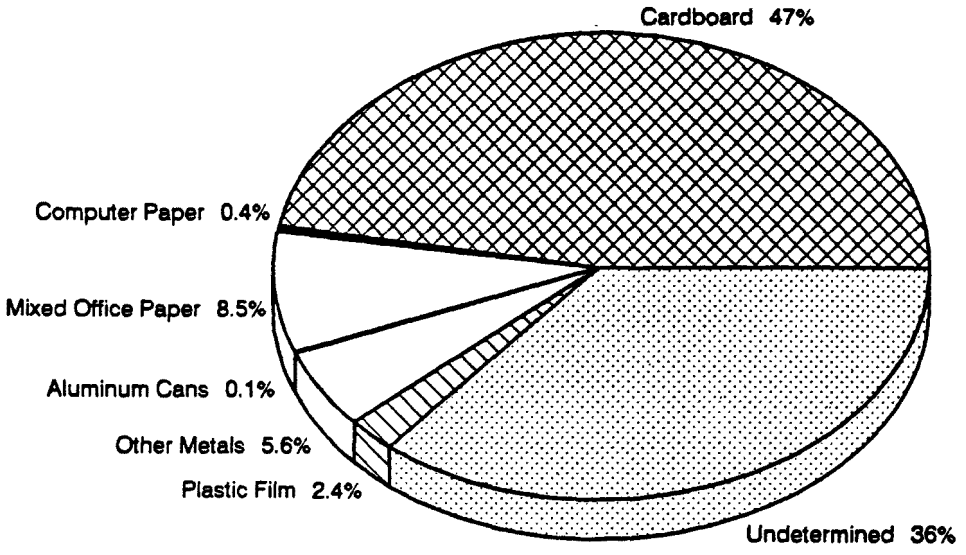
Facility maintenance operations generate used oil and waste parts cleaning solvents as well as miscellaneous cleaning and painting related wastes. Oil and used parts cleaning solvents are managed as hazardous wastes.

TABLE 1. COMPONENTS OF THE GMF WASTE STREAM

Classification	Specific Components
Major components	- OCC - old corrugated cardboard boxes and cartons
	- Plastic film - shrink wrap, stretch wrap and bags
	- Plastic strapping
	- Corrugated polypropylene boxes
	- Pallets: plastic, pressed board and pine or hardwood
	- Computer paper
	- Mixed office paper
	- Metals: machine parts, broken carts etc.
Minor Components	- Floor sweepings, primarily rubber bands and mixed colored paper
	- Employee wastes - paper towels, polystyrene cups, fast food packaging, food waste, cigarettes
	- Aluminum cans
	- Laser printer toner cartridges
Potentially hazardous components:	- Residue left in high density polyethylene bottles from inks, solvents and cleaning products
	- Aerosol cans
	- Parts cleaning solvents
	- Paints and painting solvents
	- Used oil

Operations Generating Waste

There are four areas of the GMF which generate a majority of the facility's solid waste: the unloading and loading docks, the mail sorting floor, the offices, and the facility maintenance. Auxiliary facilities such as the cafeteria, the Computer Forwarding Systems (CFS)/ Undeliverable Bulk Business Mail (UBBM), and the cafeteria, also have significant waste streams. The operations generating waste from each of these areas and auxiliary facilities are discussed below.



Total 537 tons

WASTE STREAM	QUANTITY
Cardboard	253.5 tons
Computer Paper	2 tons
Mixed Office Paper	46 tons
Aluminum Cans*	0.6 tons
Other Metals*	30 tons
Plastic Film	13 tons
Undetermined	191.9 tons

* These solid wastes were recycled throughout the period studied.

Figure 2. Estimated Solid Waste Generation.
USPS Buffalo GMF, 1991-1992

Unloading and Loading Docks

Mail is delivered to the GMF aboard trucks in packaged lots. The lots are unloaded onto the dock and transferred inside where they are sorted, processed, repacked and sent to a final destination. Corrugated cardboard, corrugated plastic, shrink wrap, stretch wrap, plastic strapping, and paper wastes are generated during the unloading and internal movement of incoming mail. The plastic shrink wrap, stretch wrap, and strapping wastes are generated from the pallets of incoming mail. Pallets (wood, wood composite, and plastic) are used throughout the facility. Pallets of outgoing mail are shrink-wrapped in the handling area; the outgoing shrink-wrapped pallets produce waste for disposal by the receiving Associate Offices (AO). Deliveries of supplies and materials are a primary source of corrugated cardboard.

Mail Sorting Floor

Mail is moved from the unloading dock to the sorting floor. The wastes generated from the mail sorting floor operation include rubber bands, paper, damaged corrugated cardboard and plastic trays and floor sweepings. A significant source of cardboard waste is the corrugated cardboard trays used in mail distribution from the receiving dock to and within the mail processing area. Corrugated polypropylene boxes are also used for internal distribution. Computer printouts with carbon paper inserts are generated on the mail sorting floor. In addition, metal wastes (e.g. machine parts, broken metal cages) and empty plastic bottles from inks and solvents are generated during operation and maintenance of the sorting and canceling machinery. A container for collection of metal for recycling is located in one corner of this area. Wastes generated by employees in break areas, locker rooms and rest rooms include coffee cups, napkins, straws, food, and paper towels. Aluminum beverage cans are collected for recycling in break areas.

Offices

Substantial amounts of mixed, colored paper and white and green bar computer printouts are generated by offices, such as Support Services. Individual work stations within the office building generate the majority of the paper waste from the GMF. The 128 person office and maintenance staff use thirty-six printers and eight copy machines. In addition, colored paper slips are used to mark the destination within the facility of boxes of mail for internal distribution.

Facility Maintenance

The carpentry shop generates wood waste such as sawdust and scrap wood while the metal shop generates scrap metal. Facility maintenance also generates plastic bags, plastic bottles and aerosol cans/wastes from the disposal of cleaning supplies. Hazardous waste generated from facility maintenance activities include paint wastes, parts cleaning solvent (petroleum naphtha), used oil, and miscellaneous chemicals such as WD-40 and cleaning compounds. The exact quantity and composition of hazardous waste generated at the GMF are unknown. The major hazardous wastes are parts cleaning solvents and used oil. Technicians clean parts using petroleum naphtha in solvent sinks. The wastes are spent solvents, a RCRA hazardous waste, and volatile organic compound (VOC) emissions. The Postal Service contracts with a commercial service that leases and maintains the solvent sinks, removes spent solvent, and replenishes the sinks with fresh solvent every six weeks at an annual cost of $569.

Based on a waste solvent generation rate of 20 gallons every 6 weeks for a 52 week year, approximately 170 gallons of waste solvent are generated annually. Used oil from letter sorting and other machinery is collected and transported to the VMF where it is stored with VMF generated waste fluids prior to removal by a commercial waste hauler.

Computer Forwarding Systems/Undeliverable Bulk Business Mail Facility

All undeliverable mail is sent to the facility housing the CFS and the UBBM operations. Undeliverable first class mail is routed to the CFS section. A computer search is performed to locate a forwarding address and a new address label is applied to the letter or parcel. The readdressed mail is then sent on to its destination. A very rigorous and thorough process is employed to locate a usable address. If an address cannot be located after this exhaustive effort, the mail is discarded. The Supervisor of the CFS examines each piece of undeliverable mail and its "paper trail" prior to disposal to ensure that all possible effort has been made to deliver the item.

UMMB (magazines, advertisements, promotional materials) is routed to the UBBM section. Bulk business mail may be undeliverable because the resident or business has moved or because the sender delivered too many copies. The UBBM section staff determine if the addressee has requested second and third class mail to be forwarded. If so, the mail is forwarded. If no such request has been made, the UBBM is discarded. Private direct marketing firms or private mailing companies often mail to all residents in a specific geographic area. If the marketing firm sends more copies than there are residents, the excess copies are delivered to the UBBM section where they are reviewed prior to disposal.

Major waste streams from the CFS/UBBM facility include undeliverable mail, magazines and promotional materials, label backing paper, and corrugated cardboard. Waste is disposed of into a four-cubic yard container that is collected twice weekly by Clinton Disposal Service at a cost of $23.09 per pull or $46.18 per week. Annual cost for collection and disposal from this facility is $2,401.36.

Cafeteria

Canteen Corporation operates the onsite cafeteria under contract to the USPS. Canteen has contractual responsibility for the cafeteria's waste disposal. The cafeteria has already established corrugated cardboard and kitchen grease recycling. Principal wastes generated by this operation include food wastes, corrugated cardboard, polystyrene plates, bowls and cups, #10 bi-metal steel cans, one gallon translucent high density polyethylene (HDPE) jars, and paper. The cafeteria has three waste containers: an eight cubic yard container for recyclable corrugated cardboard, an eight-cubic yard garbage dumpster collected four times each week, and a container for recyclable grease. Annual collection costs are: $300 for the cardboard ($25 per month) and $6,800 for the eight-cubic yard garbage container ($650 per month or just over $40 per pull). No data on the grease recycling container was provided.

SOURCE REDUCTION AND RECYCLING OPTIONS ASSESSMENT

The Buffalo USPS employees have undertaken or will enact in the near future a number of source reduction and recycling activities. The Buffalo GMF recycling program includes collecting old corrugated cardboard, ferrous metal, aluminum, and UBBM mail, and laser jet printer cartridges, and office paper for recycling. Additionally, the USPS maintenance department is investigating replacing paper towels in washrooms with electric powered air hand driers. The assessment identified other pollution prevention opportunities that build upon and expand the current pollution prevention activities.

Existing Source Reduction and Recycling Activities

A brief discussion of existing source reduction and recycling actions underway at the Buffalo GMF follows. Some of these activities were ongoing at the time of the assessment. Others have been implemented as a result of the assessment site visit and preliminary findings.

Corrugated Cardboard Recycling

The Buffalo GMF employees began recycling cardboard in late August, 1992. A local recycling company is providing the trailer to store the cardboard and pick up the cardboard at no cost to the Postal Service. The GMF employees estimate they will collect approximately 253.5 tons of cardboard per year. By separating the cardboard for recycling instead of disposing of it in the compactor the GMF has been able to reduce the number of compactor pickups from twice a week to once every three weeks. The reduced pickups are projected to save $34,000 per year in avoided disposal costs. Separating the cardboard versus throwing it into the compactor has not required additional manpower. In fact, USPS personnel estimate that recycling cardboard will require less labor since placing the cardboard in a trailer is more time efficient than placing it in the compactor.

Ferrous Metal and Aluminum Recycling

Scrap metal (20 to 30 tons/year) is collected for recycling from both the GMF and the VMF. The scrap metal is picked up by a private metal refining (smelting) company. Aluminum cans are also collected throughout the GMF.

UBBM Mail

The USPS has resumed separating UBBM mail for collection by a paper recycler. In the past UBBM was collected for recycling, however, this service was discontinued by the hauler, reportedly due to poor paper markets. The USPS contacted the waste haulers, who agreed to restart UBBM collection. The hauler will provide the trailer and pickup at no cost to the USPS.

Laser Jet Printer Cartridges

The GMF currently recycles about five laser printer cartridges each month through TC Technologies, 860 Englewood Avenue in Buffalo. Empty cartridges are cleaned and recharged by the distributor. The USPS purchases the refurbished cartridges for reuse. Annual savings amount to $1,740 with approximately 60 cartridges recycled per year. The Postal Service pays $49 for each recharged cartridge compared to $78 to purchase a new cartridge, a savings of $29 per cartridge.

Office Paper Recycling

Recycling efforts will be expanded to include mixed office paper and computer paper by the end of September 1992. The mixed paper will be picked up by a recycler at no cost to the USPS. The USPS may be paid for the computer paper, depending on the local market, or it also will be picked up at no cost to the USPS. The Buffalo GMF staff plans on expanding the recycling program to the AOs. As the GMF staff gains experience with the recycling program they will begin backhauling cardboard, mixed paper, and computer paper from the AOs to the GMF for collection by recycling companies. Separating out cardboard from the AOs waste is expected to save $18,000 per year in reduced disposal costs.

Electric Powered Hand Driers

Heightened attention to waste management and pollution prevention has paid off in additional potential savings. As a result of the assessment process, the USPS staff investigated raw materials and disposal costs for paper towels in the GMF and associate branch washrooms. The USPS spends $48,000 annually for paper towels used in the washrooms at the Buffalo GMF and Station branches. An additional $2,000 is spent for disposal of the used towels. Buffalo GMF maintenance staff investigated replacing the paper towels with electric powered air hand driers. Buffalo GMF employees determined they can replace and install the new driers at the GMF and Station branches for a total of $50,000. This would eliminate the

use of paper towels at an annual savings of approximately $50,000, minus electricity costs and any maintenance costs.

Energy Efficient Lighting

The Buffalo GMF staff have reduced the facility's energy consumption by installing energy saving fluorescent lighting and interior storm windows throughout the GMF.

Additional Source Reduction and Recycling Opportunities

A number of potential source reduction and recycling options were identified from the assessment. However, the assessment team focused on reduction of the largest components of the waste stream and the potentially toxic constituents. Table 2 summarizes the source reduction options identified. Table 3 summarizes the recycling options and Table 4 outlines general waste reduction options. The discussion which follows is organized by waste stream with source reduction and/or recycling options presented for each. Options for machinery cleaning solvent are discussed in the VMF report.

Corrugated Cardboard

The GMF generates an estimated 253.3 tons of old corrugated cardboard (OCC) per year for recycling. Until late August 1992, OCC was collected with other trash and deposited into the compactor. Collection and recycling of OCC began in August and has proven extremely cost-effective. Additional measure can be taken to reduce the quantity of cardboard waste generated. These measures are described in the following subsections.

Develop Vendor Specifications

Vendors would be required to provide products in the least possible packaging; multiple boxes within boxes would be eliminated. For example, instead of individually wrapping each ream, paper could be delivered loose in reusable cartons.

Replace The Corrugated Trays

Corrugated cardboard or fiberboard cartons are used for internal mail distribution. The cardboard or fiberboard trays have a six month life expectancy. Corrugated plastic trays have a life span of 1 to 10 years. Replacing corrugated cartons with longer life plastic cartons could reduce the amount of waste generated.

Redirect Corrugated Cardboard Boxes

Reuse of packaging delivered to the GMF to transport materials within the facility is another method to reduce the purchase and subsequent disposal of corrugated distribution packaging. When no longer usable, these boxes would be recycled.

Bale OCC for Recycling

Local paper dealers will pay $20 per bale for baled cardboard. The USPS could purchase or lease a baler to increase the value of its recycled cardboard. A cost-benefit analysis for a baler is presented in the Options Assessment section of this document.

TABLE 2. POTENTIAL SOURCE REDUCTION OPTIONS

Waste	Sources		Reduction Mechanisms
Corrugated containers	Deliveries and internal distribution	-	Advise vendors of reduced packaging specifications, use permanent distribution packaging, and reuse of packaging
Paper	Individual work stations, printers, copy machines, internal distribution	-	Initiate a duplex copying policy, duplex printing, and distribution policy, and reusable colored tags
Plastic film	Receiving dock and shipping dock	-	Use reusable containers
Plastic strapping	Receiving dock and shipping dock	-	Use reusable containers
Pallets	Receiving dock and shipping dock	-	Eliminate wood and pressed wood pallets, specify only long life, reusable plastic pallets
Rigid plastic containers	Cleaning, maintenance products and food service	-	Require bulk deliveries in refillable containers
Oils, adhesives, paints	Building maintenance	-	Improve inventory control and housekeeping practices
Cafeteria Wastes	Food packaging	-	Give customer discounts for using their own mug for beverages, make specification that only reusable food service materials (e.g., plates and bowls) be used

TABLE 3. POTENTIAL RECYCLING OPTIONS

Waste	Potential Recycling Market
Corrugated polypropylene	Container manufacturer
Paper	Local paper dealers
Plastic film	Local plastic film manufacturer
Plastic strapping	Local plastic film manufacturer
HDPE containers (translucent)	Local recycling facility
HDPE pallets	Pallet manufacturer
Pressed wood pallets	Pallet manufacturer and local composting operation
Polystyrene food service	Recycling facility located in New Jersey
Food waste	Composting operations and donate to food banks

TABLE 4. GENERAL WASTE REDUCTION OPTIONS

Method	Mechanisms
Procurement	Purchasing policy for recovered content materials and products
Waste Stream Characterization Study	Perform waste composition study to base future recommendations
Bulk mail/magazines	Alternative pricing based on life cycle analysis of revenue from bulk mailing to cost of disposal of undeliverable mail
Water and Energy Conservation	Establish a comprehensive water conservation program
	Inspect and repair toilets and sinks
	Continue energy efficiency efforts to install fluorescent lighting and interior storm windows
Improved Waste Management Cost Tracking	Establish separate account number for hazardous and solid waste management costs
	Charge waste management costs to generating department
New Specifications	Initiate new specifications for USPS goods
Employee Participation	Educate employees on pollution prevention and source reduction
Public Education	Educate customers on effective waste management

Plastic Corrugated Containers

Corrugated polypropylene containers are not widely collected for recycling at this time. However, one manufacturer, Mills Industries, Inc. of Laconia, New Hampshire, stated that a consistent quantity of these containers could potentially be recycled back into the same product. The Postal Service may wish to discuss this option with the company that supplies the containers or conduct further research into establishing a market for recycling them. Appendix B includes the contact for Mills Industries, Inc.

Paper

Paper waste can be reduced through a number of source reduction methods. Computer paper and white office paper can be recycled. Appendix B contains contact information for local paper recycling companies.

Duplex Copying

The purchase price for a basic copy machine with duplex copying capability is no higher than a machine with only single-sided capability. Whether the copies are on one side of the paper or two, the cost to operate the machine is the same. Copier charges are based on the information scanned and duplicated; for either single or duplex copies, the machine scans and reproduces the same amount of information. Savings are realized in the amount of paper used. Duplex copying can reduce paper expenditures by up to 45 percent. Double-sided copiers could be phased in as new machines are purchased. Management should establish and actively support a duplex photocopying policy.

Duplex Printing

Printers that print on both sides of the paper are also available. Sometimes, existing printers can be programmed to produce duplex copies. Most documents can be printed on both sides of the paper, reducing paper purchases as well as paper waste.

Distribution Copies

Paper waste can be reduced by limiting the number of copies of documents for distribution. Consideration should always be given to whether multiple copies are necessary. For example, the computer printout with carbon could be replaced with a recyclable, pressure sensitive NCR paper if multiple copies are necessary or with a single sheet, recyclable computer paper if only one copy is needed. In many cases, a single circulation copy can be passed on from one staff member to the next. In addition, by using a simple cover sheet containing the names of the appropriate individuals, supervisors can readily direct a single document to a circulation list rather than requesting multiple distribution copies.

Replace Disposable Paper Markers with Reusable Markers

Reusable rigid plastic or metal cards could be used to replace the colored paper destination slips.

Recycle Paper

Recyclable computer printout, sorted white ledger and mixed colored ledger grades are generated within the GMF. Local paper dealers will pay from $10 to $60 per ton for source separated computer paper or will collect a mixed paper stream at $0 return. The recyclable paper would require separate collection and storage. GMF maintenance staff and other employees should be involved in the determination of how many categories of paper separation are feasible and how to maximize the efficiency of a collection system. The paper will have to be source separated at each desk, printer and copying machine and then collected

for separate storage. Two local paper dealers are willing to place a container on site for paper and OCC at no cost to the Postal Service (see Appendix B).

Plastic Film and Strapping

Most plastic film (shrink wrap, stretch wrap) and strapping (polypropylene in an assortment of colors) discarded within the GMF is removed from incoming mail. The Buffalo facility must pay to dispose of the material. Mail shipped from Buffalo to AOs is shrink wrapped within the GMF, producing a disposal issue for the AOs. Plastic film purchases and wastes could be eliminated or severely reduced by switching to reusable cloth or net bags, wheeled bins or metal cage containers for mail redistribution. Many of these kinds of containers are already in use in the GMF and other Postal Service facilities. Specifying reusable containers for mail distribution could substantially reduce or even eliminate these wastes.

Recycle Plastic Shrink Wrap

The Rochester, New York Post Office is currently recycling shrink wrap, stretch wrap and other plastic bags and films through the local Mobil Chemical Company manufacturing facility. Mobil will pay the GMF $.11 per pound for this material including pick up at the GMF, or $.12 per pound if the shrink wrap is delivered to Rochester. The USPS could easily use its own transport equipment to arrange delivery of plastic film to the Rochester Post Office where it could be consolidated with plastic collected by that facility.

Pallets

At present, the Buffalo GMF uses three different kinds of pallets: pine, pressed board and plastic. The plastic pallets cost approximately $20 apiece; pressed wood pallets cost only $7 each. The Postal Service no longer purchases pine pallets, although many were in evidence during the assessment. Deliveries to the GMF are made on pine pallets which are then reused by the Postal Service.

Replace Wood and Pressed Wood Pallets

Plastic pallets, while more expensive to purchase initially, are more durable than wooden pallets. Charles Aldred, USPS Program Manager for Mail Transport Equipment, reports that the USPS Engineering and Development Center estimated a life of 50 trips for each plastic pallet compared to a five or six trip average life for each pressed board pallet. Based on useable life, a plastic pallet would cost approximately $.40 per trip; the pressed wood pallet would cost between $1.17 - $1.40 per trip.

Many wooden pallets arrive as deliveries to the USPS. The USPS does not have to pay for the purchase of these pallets, but currently pays for their disposal. Purchasing only the durable plastic pallets and eliminating the other two materials could reduce overall purchase and handling costs and reduce the number of pallets requiring disposal, thereby reducing disposal costs.

Recycle Pallets

The USPS purchases plastic pallets from Cadillac Products, Inc. of Sterling Heights, Michigan. The pallets are made from HDPE using twin sheet thermal forming. The HDPE has the potential to be recycled back into new pallets. The broken pallets are already separated and stacked for disposal within the GMF. The USPS should complete a cost benefit analysis to determine the advantages and disadvantages of returning these pallets to the manufacturer to be used as feedstock for new pallets. In addition, the Postal Service can specify recycled content in all pallets.

Pressed Wood

The USPS annually purchases between 1.5 and 1.8 million pressed wood pallets from Litco International, Inc. of Vienna, Ohio. Mick Marsh of Litco International stated that the Postal Service required Litco to perform a number of studies to determine the potential end uses of discarded pressed wood pallets. Based on these analyses, Litco offered the USPS a contract under which Litco would take back and either recycle or burn as fuel all the pallets sold to the Postal Service. However, the USPS has not acted on this offer and continues to pay for local disposal of the pallets.

Litco and the Agriculture Department of Ohio State University also performed extensive composting studies and found that the pressed wood pallets can be safely composted. Jim Rusiniak of the Buffalo GMF indicated an interest in composting wood waste. The Postal Service should complete a cost benefit analysis to determine the advantages and disadvantages of the recycling and disposal options available for these pallets.

Rigid Plastic Containers

The USPS purchases cleaning and maintenance supplies as well as food service products in rigid plastic containers. Since there is a consistent, long-term need for these products, the USPS should investigate purchasing these products in refillable bulk containers.

Recycle Plastic Containers

The GMF generates bottles from a variety of cleaning and maintenance products. U.S. markets for clear and cloudy, unpigmented HPDE plastic are paying between five and eight cents per pound. Since metals are already collected in a separate basket in the mail processing area, employees could be trained to separate the translucent HDPE bottles into a separate small dumpster. A local recycler could service the dumpster on an "on call" basis, initially. Once the quantity of HDPE in the waste stream is identified, a collection schedule could be developed.

Other Recycling Options

The Postal Service could also explore recycling options for materials including:

- aerosol cans
- fluorescent lights including the mercury ballasts (non-PCB)
- other non-container glass such as windows and light bulbs
- additional metals
- freon in air conditioners

Building Maintenance Waste

Facility maintenance staff perform a variety of operations that use hazardous materials or generate hazardous waste. These include painting, boiler room maintenance, and machinery repair and maintenance. The store room (room B8) houses oils, grease, cleaning compounds, and adhesives. During the site visit, the store room exhibited signs of neglect. Drums and material were stored in an unorganized manner,

unauthorized material (gasoline) was being stored; oil and grease spills were evident; material was stored in unlabeled containers; and the expiration date of limited shelf life material was not recorded.

Inventory Control and Better Housekeeping Practices

Strict inventory control procedures and good housekeeping practices can reduce waste caused by expired materials, spills and over-stocking. The following steps are recommended:

- Designate one employee as the Supply Manager (the Parts Manager is a typical choice) to be responsible for approving and ordering materials and ensuring that the supply room is kept neat and orderly. The Supply Manager checks the existing inventory to make sure that the item is not in stock prior to ordering or supplying the material.

- Control access to the supply room by allowing only the Supply Manager to distribute the supplies to the technicians.

- Keep liquid stock on lower shelves to minimize contamination of other stock and prevent product loss from accidental falls.

- Clearly label all containers with their contents and expiration date. For example, a number of containers of adhesive compound were noted during the site visit. The adhesive has a shelf life of one year from the date of purchase. However, there was no purchase date on the adhesive containers so it was not evident whether the material had exceeded its shelf life. Purchase records should be reviewed to determine when the material was purchased. If it has been over a year, the company supplying the adhesive should be contacted to see if they will take back the expired material. Expired materials can sometimes be reworked into new product at the manufacturing plant. If the adhesive can not be returned, the GMF should determine if the material is hazardous by contacting the manufacturer. If it is hazardous, it should be disposed of according to all appropriate state regulations.

- Distribute stock through "first-in, first out" practice -- this is, the oldest material should be used first.

- When possible, buy in bulk and pour materials into smaller containers for use in the shop using careful transfer procedures. All containers and drums should have self-closing, non-leak, safety spigots for easy distribution and spill prevention. Currently oil is dispensed from 55-gallon drums placed on their sides through a spigot. Buckets and drip pans are used to collect the spilled oil. To prevent spillage of dripped oil the drums should be turned vertically and oil should be dispensed using a hand pump similar to the method by which the material is dispensed in the VMF.

- Perform routine storage area inspections.

- Train technicians to maintain the smallest practical amount of hazardous materials in their work areas.

- Keep lids on all drums to prevent potential spills.

- Have spill control equipment available and ensure that employees know its location and proper use.

- Use excess paint as a primer or base coat rather than disposing of it.

- Use water-based latex paints in place of solvent-based paints when possible.

Cafeteria Wastes

Bulk deliveries of beverages are made in "bag in box" containers. While minimizing individual container disposal, these are not the most efficient bulk containers from a waste management perspective. Permanent, refillable containers would eliminate this waste.

To encourage employees to think about waste reduction, the cafeteria could offer a reduced price on beverages if the customer brings his or her own mug. Perhaps a five cent discount would encourage Postal Service employees to participate. The Postal Service or Canteen might consider selling or giving away reusable mugs with a Postal Service logo.

The cafeteria presently recycles cardboard and kitchen grease. The principal cafeteria waste is polystyrene food service (e.g. plates and trays). Markets for polystyrene recycling have increased substantially in recent years. The USPS should consider modifying the cafeteria contract to require recycling of this material as well as food and beverage containers, if economically viable markets exist. Or, through the contract mechanism, the Postal Service could prohibit the use of disposable items and specify the use of washable, reusable food service and the installation of a dishwasher.

Other materials for which viable recycling markets exist include the #10 steel cans and translucent HDPE jars in which foodstuffs are delivered. These materials are easily separated in the kitchen, and local recycling markets are available.

Canteen could explore a composting option for the food waste and paper products. Garrett Dolan or Jim Gilbert at the New York State Department of Economic Development in Rochester can provide contacts and assistance. Also, the New York State Department of Environmental Conservation, Division of Solid Waste, Region IX has a Buffalo office that maintains records of local markets for recyclable commodities. Another method of reducing food waste is by donating excess food to a local homeless shelter or food bank.

General Waste Reduction Options

Procurement

To comply with the Resource Conservation and Recovery Act, Section 6002, Federal Procurement, and Executive Order 12780, October, 1991, Federal Agency Recycling and the Council of Recycling and Procurement Policy, the USPS has begun to develop an Affirmative Procurement Program. The GMF could establish vendor certification and internal and external promotion of a purchasing policy to give preference to products and materials with recovered content. These procurement policies potentially increase the possibility that products and packages will be manufactured with recovered material, thus reinforcing markets for the materials the Postal Service will be recycling. Procurement specifications for paper and paper products, retread tires, rerefined lubricating oil, building insulation products, and cement and concrete should reflect EPA guidelines.

The Buffalo GMF is authorized to establish voluntary standards for procurement of other items manufactured with recovered materials. For example, GMF purchasing staff could review procurement specifications to eliminate any that discriminate against products containing recovered material. Employees and vendors should be aware that all paper products, from white ledger to toilet tissue can be purchased

with recovered contents. This procurement policy should extend to contractors including the cafeteria, which should order napkins and other paper products with 50 percent recovered content.

The USPS could use procurement as a tool to support the development of pollution prevention programs. Specifications and standards that give preference to virgin materials or materials that cannot be reused or recycled should be eliminated. The USPS could develop a policy giving preference to non-toxic products, whenever performance and safety standards can be met. While the Postal Service is reviewing specifications related to the Procurement Guidelines, a more general review of procurement policy is recommended.

A policy that gives preference to non-toxic products and packages would facilitate changes in USPS procurement specifications that could reduce the toxicity of the waste stream. For example, USPS could specify non-aerosol containers for cleaning and maintenance products, except those specific applications for which no non-aerosol exists. The propellants used in pressurized aerosols are primarily butane and propane, both of which are generally toxic; in most cases, pump spray or liquid products could be substituted. This procurement policy would effectively reduce or eliminate the use of disposal of aerosol containers.

Waste Stream Characterization Study

A full-scale waste composition study would provide real, accurate numbers on which future recommendations could be based. This data would identify cost, justify capital improvements and lead to improved operations. To ensure accurate, long-range planning for future waste management, the Postal Service could conduct a rigorous waste composition analysis at the Buffalo GMF. A composition analysis would accurately identify the quantities and sources of each waste material. Waste containers could be numbered or color coded by operation. Then, specific waste containers could be selected for a complete composition analysis in which the diverse waste components are separated and weighed to verify exactly what materials and in what quantities specific materials are generated by each operation. An alternative composition analysis technique would require employees to sort and weigh one or more compactor loads. This approach would determine the relative percentages of specific materials in the waste stream but would not target their sources.

Bulk Mail and Magazines/Life-Cycle Analysis Study

UBBM constitutes a substantial input to the CFS/UBBM waste stream. The USPS is reluctant to impose restrictions on bulk mailing because of the revenues generated. However the USPS incurs a cost, unquantified at this time, to process, transport and dispose of UBBM. A life-cycle analysis to compare the revenue from bulk business mail to the costs of UBBM would quantify the cost to handle, transport and dispose of UBBM. Comparing this cost to the revenue gained from bulk mailing fees will identify the net benefit or cost for the entire life cycle of UBBM. Based on this analysis, the USPS could consider including the cost of transporting, handling and disposing of undeliverable mail in the bulk mailing fees. To reduce the amount of UBBM the Postal Service could require regular updating of mailing lists especially for third and fourth class mail. Currently, the Postal Service provides a mailing list maintenance service, however, it is not well advertised. The USPS has an active dialogue with trade associations and bulk mailing concerns through regular meetings. The national implications of these options warrant that they be more appropriately discussed at upper management levels within the USPS.

Water and Energy Conservation

The Buffalo GMF and VMF jointly used 1,564 gallons of water and discharged 2,229 gallons to the sewage system from January 1991 through March 1991. The water and sewer bill for this quarter was $3,793.68. A comprehensive water conservation program will conserve water and reduce USPS costs. This

would include regular inspection and repair of sinks and toilets. As a first step, water meters could be installed to record water usage in high water use areas such as the vehicle washing equipment area.

The GMF staff has actively implemented energy conservation efforts by installing fluorescent lighting and interior storm windows. These commendable efforts should be continued. Consideration should also be given to motion or sound sensitive lighting.

Improved Waste Management Cost Tracking

The results of the waste stream characterization study recommended above would provide information to facilitate waste tracking. Designating a separate account number for hazardous and solid waste management costs would improve the USPS's ability to identify and track waste management costs. Under the present system waste management costs are folded into the overall service account. Identification and tracking of specific waste management costs is difficult. Designating a specific account number for waste management costs has a number of benefits. It would allow the USPS to more easily monitor waste management costs over time. Sudden or gradual increases in waste management costs could signal changes in waste generation operations or improper waste management practices that should be investigated. USPS staff could associate waste management costs with individual operations or departments. The USPS should also consider apportioning or "charging" waste management costs to the department generating the wastes. Making each department aware of and responsible for waste management costs provides an additional incentive to reduce waste.

More focused waste management cost accounting also eases the tracking of economic impacts of waste reduction options on waste management costs. Waste management is often a hidden cost. By explicitly identifying these costs, facilities can weigh the costs and benefits of different waste reduction options and, more importantly, quantify savings or losses from instituted waste reduction techniques.

Promote Affirmative Procurement and Facilitate Public Recycling

All paper products distributed by the Postal Service could be manufactured with recovered materials and promoted as recycled and recyclable. The Postal Service currently distributes one envelope and one stamp which are made from recycled paper, water-soluble inks, and water-soluble adhesives. Additionally, nineteen postcards printed on recycled paper are currently available from the Postal Service. The Postal Service could expand this to initiate new specifications that would encourage procurement of products containing recovered materials and enhance the recyclability of the waste stream. For example, the Postal Service could require that windows in envelopes be made of recyclable cellulose rather than non-recyclable plastic. A price advantage could be offered to bulk mailers who certify that the paper and envelopes used contain a minimum of 50 percent recovered paper.

Employee Participation

Active support and participation by all USPS employees is critical to the GMF's pollution prevention program. Implementing the recommendations presented in this report hinges on employee commitment. A major factor in implementing and sustaining source reduction and recycling efforts is employee education. USPS staff need to understand why pollution prevention is important and how they can help. Management must communicate pollution prevention goals and activities and find avenues to solicit worker input on ways to improve the program. Establishing and maintaining a successful source reduction and recycling program requires constant effort and monitoring. A proactive training program and open communication can help ensure proper performance. Table 5 lists key ways to maintain and improve a pollution prevention program. Appendix C contains a fact sheet about pollution prevention at USPS GMFs. This factsheet provides USPS employees with information on how to reduce or recycle wastes from GMF operations.

Pollution Prevention Resources and Training Opportunities in 1992 (EPA/560/8-92-002) is an extremely helpful document that provides guidance on successful employee involvement and training. This document is an annual guide containing information about publicly-sponsored pollution prevention resources and training opportunities available across the U.S. Its goal is to provide a single source of pollution prevention options to those interested in learning more about such strategies.

The document contains information such as 1) available training courses or contacts who are willing to share experiences about establishing new training opportunities, 2) availability of pollution prevention publications and videos, 3) Federal and State contacts, 4) availability of university research and training, and 5) Federal, State, and nonprofit organizations that can provide additional pollution prevention information and technical assistance. Additional information can be obtained by accessing the Pollution Prevention Information Clearinghouse (PPIC), which offers a wide range of free information services.

TABLE 5. KEY WAYS TO MAINTAIN AND IMPROVE A POLLUTION PREVENTION PROGRAM

General Goals	Specific Methods
Integrate pollution prevention into corporate planning	Assign pollution prevention accountability to the operating units where waste is generated
	Track and report program status
	Conduct an annual program evaluation at the corporate level
Provide ongoing staff education programs	Make pollution prevention awareness program a part of new employee orientation
	Provide advanced training
	Retrain supervisors and employees
Maintain internal communication	Encourage two-way communication between employees and management
	Solicit employees' pollution prevention suggestions
	Follow-up on suggestions
Reward personnel for their success in pollution prevention	Cite accomplishment in performance reviews
	Recognize individual and group contributions
	Grant material rewards
	Consider pollution prevention a job responsibility subject to review
Provide public outreach and education about pollution prevention efforts	Submit process releases on innovations to local media and to industry journals read by prospective clients
	Arrange for employees to speak publicly about pollution prevention measures in schools and civic organizations.

Source: Facility Pollution Planning Guide (EPA May 1992)

Complimentary copies of the manual as well as additional information on the PPIC can be obtained by calling the Pollution Prevention Information Clearinghouse Hotline at (703) 821-4800 or writing to:

Pollution Prevention Information Clearinghouse
Technical Information Service
c/o Science Applications International Corporation
7600 A Leesburg Pike
Falls Church, VA 22043

Public Education

The USPS could use its lobby space to educate customers about effective waste management. The USPS should promote its own source reduction and recycling program by publicizing the amount of waste reduced, and resources and energy saved.

Options Ranking

Ranking is the process of classifying pollution prevention options for further study and action. Each option is judged against a set of criteria. The criteria list the major positive and negative factors influencing implementation. These criteria take into account environmental, economic, and implementation considerations identified from the site visit, interviews with USPS employees, and information taken from the worksheets. The qualitative ranking system is based on the assumption that each option will have either a positive (more efficient, more cost effective, more resource conservative), neutral, or negative (more labor intensive, more expensive, incompatible) effect on current operations. Using a system of one through five, with three as a neutral point, each option was ranked. The ranking results are shown in Table 6. Ranking the options creates a prioritized list of recommended pollution prevention projects that the USPS might pursue. Options with the highest scores are the most immediately effective and/or the easiest to implement. Some pollution prevention options were not ranked because they have very low capital costs, the benefits of each option are not easily quantified, or the option does not lend itself to the ranking criteria. While unranked, these options are included in the implementation plan discussion.

FEASIBILITY

A limited technical and economic feasibility assessment for each of the major source reduction and recycling options was undertaken. This section discusses capital and/or operation and maintenance costs associated with the option, operational differences, wastes reduced/eliminated, and implementation barriers. The discussion will focus on the different types of waste materials.

Corrugated Cartons

Corrugated cardboard is a substantial GMF waste. Source reduction and recycle options for this waste are readily accessible for this waste. Replacing corrugated cardboard and polypropylene cartons with longer life plastic cartons can lead to economic benefits. Cardboard or fiberboard trays cost $0.32 each and have a six month life expectancy with a per month cost of $0.05. The corrugated plastic trays cost from $1.10 to $1.50 each and have a life expectancy of one to ten years, depending on the manufacturer. Assuming a five year life expectancy and a cost of $1.30, the corrugated plastic tray costs $.02 per month. Over a five year period, corrugated plastic trays are found to be a more cost effective choice than the corrugated paper trays. The GMF should request the longer life corrugated plastic trays instead of the shorter life corrugated cardboard cartons.

TABLE 6. QUALITATIVE RANKING OF RECOMMENDED ACTIVITIES

CRITERIA	Recycle corrugated cardboard	Recycle shrink wrap, stretch wrap, other film, strapping	Recycle computer and office paper	Recycle corrugated plastic boxes	Recycle high density polyethylene (HDPE) bottles	Purchase only HDPE pallets and recycle them	Recycle pressed wood pallets	Backhaul recyclables from AOs	Establish affirmative procurement program	Expand APP to contractors	Duplex copying policy and training
Compatibility with existing operating procedures	3	3	2	3	2	2	3	2	2	3	2
Capital cost	3	3	3	3	3	3	3	3	3	3	2
Conserve resources	5	5	5	5	5	5	5	5	5	5	5
Additional labor requirements	3	3	2	3	3	3	3	2	3	3	4
Additional space requirements	3	3	2	2	2	3	3	3	3	3	3
Ease of implementation	5	5	3	4	2	1	4	2	2	2	3
Implementation period	5	5	5	2	4	1	2	3	2	2	4
Extent of current use in industry	5	5	5	2	4	2	4	4	2	2	4
Reduction of disposal costs	5	5	5	5	5	5	5	3	3	3	4
TOTAL	37	37	32	29	30	25	32	27	25	26	31

5 = very positive
4 = positive
3 = neutral
2 = somewhat negative
1 = very negative

Another option is to replace both kinds of disposable containers with reusable metal or rigid plastic containers. If these containers are damaged beyond repair, the metal containers could be recycled within the current metal recycling program and the rigid plastic containers have the potential to be recycled back into the same product.

Local paper dealers will collect loose corrugated cardboard from the GMF at no charge and zero payment. However, paper dealers will pay a $20 premium per ton for baled corrugated cardboard. With either option, the waste collection system would not require alteration, since the maintenance staff could remove OCC from the waste and deposit it into a separate container or into the baler. It would be necessary to set aside a bay for the storage container and additional storage space for the bales of OCC.

Table 7 is a cost/benefit analysis of recycling loose and baled corrugated cardboard. It appears that recycling loose OCC represents the best option at this time. However, if the premium for baled corrugated cardboard or the volume of material generated by the GMF increases, the cost of a baler may be justified.

Plastic Film and Strapping

Plastic film is another large component of the GMF waste stream that can be readily recycled. The Buffalo GMF could follow the lead of the Rochester New York Post Office which is currently recycling shrink wrap, stretch wrap and other plastic bags and films through the local Mobil Chemical Company manufacturing facility. Mobile Chemical Corporation will pay the GMF $0.11 per pound for this material if they collect it at the GMF and $0.12 per pound if the material is delivered to the recycling facility in Rochester. The Buffalo GMF generates approximately 90-100 pounds of plastic film per day for an estimated annual payback of $4,380. The annual avoided disposal figure would be $1,105. Total annual return to the Postal Service for recycling plastic film would be $5,485.

The plastic shrink wrap can be collected as mail is unwrapped while other plastic films can be separated from mixed waste on the dock. Transportation to the recycling facility can be accomplished through the regular movement of mail and equipment between the GMF and the Rochester Post Office, or Mobile Chemical Corporation can collect it. To initiate this recycling option, the Buffalo GMF should deliver the film to the Mobile Chemical Corporation facility in Rochester or allow Mobile Chemical Corporation to collect it in Buffalo. Once this decision has been made, a container for the film can be located near the compactor and recycling can begin.

Plastic film presents a disposal problem not only for the Buffalo GMF but for all AOs receiving shrink-wrapped mail from Buffalo. Replacement of shrink-wrap with permanent, reusable distribution packaging would represent an initial capital cost, but over time would eliminate the cost of purchasing the plastic film, the labor and electricity used to shrink wrap the pallets as well as the disposal costs for Buffalo and the AOs.

Mobile Chemical Corporation may also be willing to accept the polypropylene plastic strapping for recycling. This option requires further discussion with Mobile Chemical Corporation. However, separation of the strapping on the dock is readily implemented. The Postal Service could maximize the recyclability of the plastic strapping by purchasing only one resin and color of strapping. A larger quantity of a consistent commodity is more easily marketed, than the mixture of three different colors of strapping that is currently being generated. Apparently, different strapping machines require different sizes of strapping and the sizes are differentiated by color. The Post Service could standardize the strapping machinery to facilitate recycling of the strapping.

TABLE 7. COST/BENEFIT ANALYSIS FOR OCC RECYCLING

Recycle OCC	Baled	Loose
Equipment Transportation Installation	$8500 baler purchased	0
Electric power	<$10/year 89 kilowatt hrs./yr.	0
Labor	$4292 (4.5 hours per week @ $ 18.34 per hour)	0 (Net decrease in labor compared to disposal in compactor)
Baling wire	$570	0
Routine maintenance	$250	0
Total Annual Operating and Maintenance Costs	$5,122	0
Avoided Costs	**$34,000 (Reduce compactor pick-up @ $405.20/pick-up from bi-weekly to once every three weeks)**	**$34,000 (Reduce compactor pick-up @ $405.20/pick-up from bi-weekly to once every three weeks)**
Revenue	$5,060 (253 tons @ $20.00/ton)	0
Total Benefit	$39,060	$34,000
First Year Benefit = Return - Cost	$25,438 ($39,060 - $13,622)	$34,000
Year 2 and Following Benefit	$33,938 ($39,060 - $5,122)	$34,000

Recycling

Recycling is an option for a number of different materials generated at the GMF and presently disposed of. The following discussion provides an overview of establishing a recycling system by identifying the major recycling system considerations and factors.

Setting up a recycling program can require an investment of both time and money. The first step is designing a collection program. Each employee must have access to recycling collection containers and must understand what materials are acceptable. Equipment may be necessary to process the recyclables. An area must be set aside to store the recyclables before they are taken to a market. Before collection can begin, the staff must locate a reliable market that will accept or purchase each recyclable commodity. Recycling markets are traditionally unstable, with frequent fluctuations in the amount paid per ton of

recyclable material. Often, the recycler will accept the material but pay nothing at all or charge a fee to collect and process the material.

Access to markets willing to accept or purchase recyclable materials may represent a barrier to the implementation of some of the recommended recycling options. Collection programs are readily implemented, but are useless without an appropriate recycling infrastructure. For some materials, distance from the markets may represent a significant barrier; for others, local markets may provide a significant return on the material. Recycling operations can be profitable; the key is knowing the market options.

It is best not to base an evaluation of recycling on the potential sale of the recyclables. In many cases, even if a charge is incurred, the program may still be economically beneficial. Attention should focus on the potential avoided cost of disposing of the materials. For the Buffalo GMF, each ton of material delivered to a recycler at no cost represents a potential $85 savings in avoided disposal fees. Over the past ten years, the cost of solid waste disposal has risen far more rapidly than the rate of inflation. Because of new environmental standards imposed by the Clean Air Act and the Land Disposal Rule, it will be more expensive to operate landfills and incinerators in the future. Projections suggest that disposal costs will continue to exceed the rate of inflation for the foreseeable future.

In addition to collecting materials for recycling at the Buffalo location GMF management could also implement a program to backhaul recyclables from AOs to the GMF for consolidation and marketing. This would make it easier to implement a broad scale recycling program and would eliminate the need for each office to initiate market arrangements.

For each potentially recyclable material, staff of the Buffalo GMF will need to answer a series of questions shown in Table 8. Thorough attention to program development will ensure the success of the recycling efforts.

Potential Implementation Barriers

Implementing an option may require overcoming economic, technical, and/or policy barriers. This sections identifies potential barriers to implementing the identified pollution prevention options. Reduction in the number of corrugated containers and pallets, and the amount of plastic film and strapping is hampered by the need to purchase long-life, reusable alternatives for these materials. A major barrier to waste reduction is the Postal Service procurement policy that focuses on short-term rather than life-cycle costs. For example, the Postal Service allocates a specific amount of money for the purchase of a specific number of pallets or corrugated distribution packages. If the immediate purchase price of the reusable alternative is higher, the Postal Service will not purchase it even if the long-term, life cycle costs are lower.

Another barrier to replacing corrugated containers with longer life corrugated plastic trays is the inconsistent quality of the corrugated plastic trays. Some vendors provide high quality, long-life products while other vendors provide lower quality, shorter life trays from which the handles frequently rip and are easily crushed or torn. The corrugated plastics industry does not have an industry-wide agency to ensure consistency in product quality while the fiberboard quality is ensured by the Technical Association of Pulp and Paper Industries.

The major barrier to recycling pressed wood, plastic pallets and the corrugated plastic distribution bins is the distance to the market. In each case, the manufacturer of the product accept it for recycling, but the markets are located at a distance from Buffalo. The long-term environmental and economic benefits of recycling these items require further research.

TABLE 8. RECYCLING PROGRAM DEVELOPMENT FACTORS

Development Factor	Questions to be Answered
Education	How will current employees, new employees and visitors to the facility be informed of their responsibilities in relation to the recycling program? Who will monitor program successes and failures? How will this information be circulated? What, if any, enforcement procedures will be used?
Internal Collection	How will the material be collected from individuals? Will there be a box on or next to each work station? a box in each office or area? several drop-off containers in break rooms or hallways? reverse vending machines?
External Collection	How frequently and by whom will the recyclable material be collected from the containers? Where will it be taken? Is processing necessary? Is processing equipment available? If interim on-site storage is necessary, where and in what kind and size container?
Transportation and Markets	Who will remove the recyclables from the GMF? Where will they be taken?
Cost	Will the GMF pay any costs for the collection, transportation and/or marketing of the recyclable(s)?
Revenue	Will the GMF receive any revenue generated by recycling?
Waste Removal	Will the waste removal system change as a result of recycling? Are different kinds or sizes of containers needed? Will trash be picked up more or less frequently?

Paper

Recycling computer and mixed office paper is limited only by the implementation process. Decisions about collection containers and custodial responsibilities must be resolved and the staff educated. In addition, local markets for recycled paper should be investigated and haulers selected before a paper recycling program can be implemented. However, paper recycling could be in place in a relatively short amount of time.

Once a recycling program is initiated, a waste hauler should be contacted to arrange an on-call schedule for compactor pulls. The GMF staff should keep detailed records of the percent the compactor is filled and the length of time between pulls. As the waste reduction and recycling programs expand, the compactor can be replaced with a smaller, less costly container.

Reduction in the amount of paper being discarded can be accomplished immediately. The Buffalo GMF has sufficient duplex copying capability, and the remaining single-sided machines can be replaced with machines with duplex capability as they are wear out. In addition, a new duplex copying policy should be implemented through a simple policy statement from the Postmaster. This should be reinforced through training and supervision.

Procurement

The Buffalo GMF may be able to change specific local procurement language to increase bulk deliveries of supplies. However, if these items are acquired through the USPS Requiring Office, the time required to implement such a change will be significant.

IMPLEMENTATION PLAN

Table 9 lists source reduction and recycling options as either immediate, intermediate or long-term options based on the ease of implementation. Immediate options require relatively little effort and capital, intermediate options require an intermediate amount of planning, decision-making and capital expenditure, and long-term options require developing or modifying policies at the regional or national USPS level, working with other Agencies, or establishing new programs. The factors influencing the ease or difficulty of implementation were discussed in the Feasibility section. A more in-depth, USPS implementation plan could be developed using the information in the Feasibility section and Table 9 as a start.

CONCLUSIONS

USPS Buffalo employees have enacted a number of source reduction and recycling activities. These include installing energy saving fluorescent lighting and interior storm windows; collecting cardboard, UBBM, ferrous metal, and aluminum for recycling; and purchasing reconditioned printer cartridges. These activities have significantly reduced waste disposed from the GMF. Additional pollution prevention activities scheduled for enactment at the GMF are collecting white and mixed office paper for recycling and replacing paper towels in washrooms with electric powered air hand driers. Current and planned pollution prevention practices, excluding energy savings, will save the USPS an estimated $96,556 annually, as shown in Table 10. These estimated annual returns were calculated based on recycling and disposal markets in the Buffalo area in September 1992. Recycling cardboard alone is projected to divert approximately 253 tons of solid waste from the waste to energy incinerator and save an estimated $34,000 in avoided disposal fees annually. In addition, collecting cardboard for recycling has reduced waste by over 50 percent, surpassing the USPS requirement that facilities reduce 1992 waste levels by 25 percent by 1993.

Implementing the pollution prevention opportunities identified in this report can further eliminate wastes and reduce operating and disposal costs. Projected cost savings from recycling plastic film are estimated at $5,485 annually. Cost savings from the other options are not quantifiable due to incomplete data on waste quantities. Affirmative procurement could further reduce solid waste by specifying minimum packaging. Affirmative procurement also closes the recycling loop by supporting markets for recycled goods.

The Buffalo GMF has several characteristics that favor a successful pollution prevention program:

- A core of enthusiastic and committed USPS staff
- Top level commitment to pollution prevention as shown in pollution prevention policies and waste reduction goals
- Buffalo GMF management commitment as shown by their participation in this project
- Adequate quantities of recyclable materials to interest recycling vendors
- Adequate storage space for recyclable materials and containers
- Local markets for most recyclable wastes

TABLE 9. IMPLEMENTATION PLAN

Ease of Implementation	Options
Immediate Implementation/ Low Barriers	Paper reduction through duplex copying and routing slips
	Plastic film recycling
	Find aerosol container substitutes
	Recycle toner cartridges
	Improved inventory control and better housekeeping practices
	Improved waste management cost tracking
	Public education
	Employee training program
Intermediate Implementation/ Medium Barriers	Investigate purchasing a cardboard baler
	Establish a recycling program for mixed office paper and computer paper
Long-Term Implementation/ High Barriers	Modify procurement policy to encourage purchase of long-life materials (for corrugated containers, pallets, plastic film and strapping)
	Modify procurement policy to prohibit aerosol containers and increase bulk deliveries
	Study recycling potential for pallets and plastic distribution bins
	Modify cafeteria contract to promote source reduction and recycling
	Investigate bulk mail policy to modify mailing rates based on USPS's lifecycle costs of UBBM
	Recycle aerosol cans
	Recycle fluorescent lights including the mercury ballasts (non-PCB)
	Recycle other non-container glass such as windows and light bulbs
	Recycle additional metals

Though barriers to implementation may be encountered, such as USPS current procurement policy and uncertainty of a reliable market for recycling materials, most pollution prevention options presented remain viable. A few of the options require Postal Service action at the national level. Items such as pressed wood pallets and corrugated cardboard trays are acquired indirectly by the Buffalo GMF through the USPS National Requiring Office. For certain other items, vendor specifications that favor recyclability,

recycled content, or minimal packaging can be generated at the Buffalo GMF but will have a greater impact if developed nationally.

Applicability to Other GMFs

Many of the options outlined in this report could be implemented at the other 270 GMFs in the United States. Waste reduction options, such as recycling laser printer cartridges and conserving water, require little or no capital investment. Other options may require the purchase of equipment such as collection bins for recyclables, energy-efficient lights, storm windows, or duplex copiers. Given the similarity of operations at GMFs, the recommendations contained in this report, including the estimated net annual benefits and payback, should be generally applicable to the other GMFs. Because factors such as the availability and strength of recycling markets vary regionally, USPS facilities outside the Buffalo area are advised to research such conditions carefully before making investments in recycling equipment. Disposal costs and markets for recyclables are likely to be significantly different in other areas or at other times. For example, there is a Mobil Chemical Company manufacturing facility within 100 miles of the Buffalo GMF that will purchase and recycle plastic film. A market for plastic film may not be available in many other areas. When recycling markets are available, it is important to consider benefits such as avoided disposal costs and reduced liability even if the USPS facility receives no payment (or is subject to a minimal fee) for the recyclables.

TABLE 10. ESTIMATED ANNUAL RETURN FROM SOURCE REDUCTION AND RECYCLING USPS GMF, BUFFALO, NY

Action	Potential Monetary Benefit
Current Practices	
Recycle laser printer cartridges	$1,740
Recycle aluminum cans	$1,011
Recycle scrap metal	$2,125
Recycle loose cardboard	$34,000
Subtotal (current practices)	**$38,876**
Recommended Measures	
Recycle plastic film	$5,485
Subtotal (recommended measures)	**$5,485**
Recently Implemented or Proposed	
Recycle computer paper	$240
Recycle mixed office paper	$1,955
Replace paper hand towels with electric air dryers (2)	$50,000
Subtotal	**$52,195**
Total	**$96,556**

Notes:

1. Monetary benefits include a $85 per ton avoided disposal cost and payment for recyclable materials (aluminum, plastic film, and computer paper). Disposal costs for other locations may differ significantly from this value. Payment for recyclable materials is based on the September 1992 market in the Buffalo area. Any use of these numbers must recognize the fact that markets for recyclable materials vary greatly with time and location.

2. Includes replacing hand towels at Buffalo GMF and Station Branches.

APPENDIX A

WORKSHEETS

Firm USPS Site Buffalo, NY - GMF Date April 1992	Waste Minimization Assessment Worksheets Proj. No.	Prepared By Checked By Sheet 1 of 1 Page 1 of 1

Worksheet S2

SITE DESCRIPTION

EPA

Firm: *U.S. Postal Service*
Plant: *Buffalo New York*
Department: *General Mail Facility*
Area:
Street Address: *1200 Williams Street*
City: *Buffalo*
State/ZIP Code: *NY*
Telephone: ( )
Major Products: *U.S. Mail processing facility*
SIC Codes:
EPA Generator Number:
Major Unit or:
Product or:
Operations: *The Buffalo GMF Serves as the area distribution center for zip code areas 140-149, the state distribution for flats and 3rd class mail for zip code 130-149, the mail processing center for all 17 stations and branches in Buffalo, and the Sectional Center Facility for 104 associate offices.*
Facilities/Equipment Age: *Occupied site since 1963.*

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - GMF		Checked By
Date April 1992	Proj. No.	Sheet 1 of 1 Page 1 of 4

Worksheet S6

WASTE STREAM SUMMARY

EPA

Attribute		Description[1]					
		Stream No. 1		Stream No. 1		Stream No. 1	
Waste ID/Name:		*Cardboard*		*Computer paper*		*Office paper*	
Source/Origin		*Docks sorting floor*		*Offices*		*Offices*	
Component/or Property of Concern		*Solid waste*		*Solid waste*		*Solid waste*	
Annual Generation Rate (units tons)		*> 200*		*2*		*> 23*	
• Overall		*> 200*		*2*		*> 23*	
• Component(s) of Concern		*N/A*		*N/A*		*N/A*	
Cost of Disposal		*$90/ton*		*$90/ton*		*$90/ton*	
• Unit Cost ($ per: $90/ton)							
• Overall (per year)		*$18,000*		*$180*		*1,970*	
Method of Management[2]		*Solid waste incinerator*		*Solid waste incinerator*		*Solid waste incinerator*	
Priority Rating Criteria[3]	Relative Wt. (W)	Rating (R)	R x W	Rating (R)	R x W	Rating (R)	R x W
Regulatory Compliance		*N/A*		*N/A*		*N/A*	
Treatment/Disposal Cost		*High*		*High*		*N/A*	
Potential Liability		*Low*		*Low*		*Low*	
Waste Quantity Generated		*High*		*Low*		*Medium*	
Waste Hazard		*Low*		*Low*		*Low*	
Safety Hazard		*Low*		*Low*		*Low*	
Minimization Potential		*High*		*High*		*High*	
Potential to Remove Bottleneck		*N/A*		*N/A*		*N/A*	
Potential By-product Recovery		*N/A*		*N/A*		*N/A*	
Sum of Priority Rating Scores		*Σ(RxW)*		*Σ(RxW)*		*Σ(RxW)*	
Priority Rank		*High*		*High*		*High*	

[1]For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
[2]Rate each stream in each category on a scale from 0 (none) to 10 (high).

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - GMF		Checked By
Date April 1992	Proj. No.	Sheet 1 of 1 Page 2 of 4

Worksheet S6

WASTE STREAM SUMMARY

EPA

Attribute		Description[1]					
		Stream No. 1		Stream No. 1		Stream No. 2	
Waste ID/Name:		*Plastic Film*		*Pallets*		*Bulk Mail*	
Source/Origin		*Loading Docks*		*Loading Docks*		*Undeliverable bulk business mail*	
Component/or Property of Concern		*Solid waste*		*Solid waste*		*Solid waste*	
Annual Generation Rate (units *tons*)		*13*		*Unknown*		*4 yd³/3 days*	
• Overall		*13*					
• Component(s) of Concern		*N/A*		*N/A*		*N/A*	
Cost of Disposal							
• Unit Cost ($ per: *$90/ton*)		*$90/ton*		*$90/ton*		*$23 per pull*	
• Overall (per year)		*$11,700*		*Unknown*		*$2,400*	
Method of Management[2]		*Solid waste incinerator*		*Solid waste incinerator*		*Solid waste incinerator*	
Priority Rating Criteria[2]	Relative Wt. (W)	Rating (R)	R x W	Rating (R)	R x W	Rating (R)	R x W
Regulatory Compliance		*N/A*		*N/A*		*N/A*	
Treatment/Disposal Cost		*High*		*Unknown*		*Medium*	
Potential Liability		*Low*		*Low*		*Low*	
Waste Quantity Generated		*High*		*Unknown*		*Medium*	
Waste Hazard		*Low*		*Low*		*Low*	
Safety Hazard		*Low*		*Low*		*Low*	
Minimization Potential		*Medium*		*Medium*		*Low*	
Potential to Remove Bottleneck		*N/A*				*N/A*	
Potential By-product Recovery		*N/A*				*N/A*	
Sum of Priority Rating Scores		*Σ(RxW)*		*Σ(RxW)*		*Σ(RxW)*	
Priority Rank		*Medium*		*Medium*		*Medium*	

[1]For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
[2]Rate each stream in each category on a scale from 0 (none) to 10 (high).

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - GMF		Checked By
Date April 1992	Proj. No.	Sheet 1 of 1 Page 3 of 4

Worksheet S6

WASTE STREAM SUMMARY

EPA

Attribute		Description[1]					
		Stream No. 2		Stream No. 2		Stream No. 2	
Waste ID/Name		*Cans*		*Polystyrene*		*Foodwaste*	
Source/Origin		*Cafeteria*		*Cafeteria*		*Cafeteria*	
Component/or Property of Concern		*Solid waste*		*Solid waste*		*Solid waste*	
Annual Generation Rate (units_____)		*Unknown*		*Unknown*		*Unknown*	
• Overall		*Unknown*		*Unknown*		*Unknown*	
• Component(s) of Concern		*N/A*		*N/A*		*N/A*	
Cost of Disposal							
• Unit Cost ($ per: *Poll.*)		*$40*		*$40*		*$40*	
• Overall (per year)		*$6,800*		*$6,800*		*$6,800*	
Method of Management[2]		*Solid waste incinerator*		*Solid waste incinerator*		*Solid waste incinerator*	
Priority Rating Criteria[3]	Relative Wt. (W)	Rating (R)	R x W	Rating (R)	R x W	Rating (R)	R x W
Regulatory Compliance		*N/A*		*N/A*		*N/A*	
Treatment/Disposal Cost		*High*		*High*		*High*	
Potential Liability		*Low*		*Low*		*Low*	
Waste Quantity Generated		*Low*		*Low*		*High*	
Waste Hazard		*Low*		*Low*		*Low*	
Safety Hazard		*Low*		*low*		*Low*	
Minimization Potential		*High*		*Medium*		*Low*	
Potential to Remove Bottleneck		*N/A*		*N/A*		*N/A*	
Potential By-product Recovery		*N/A*		*N/A*		*N/A*	
Sum of Priority Rating Scores		*Σ(RxW)*		*Σ(RxW)*		*Σ(RxW)*	
Priority Rank		*Medium*		*Medium*		*Low*	

[1]For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
[2]Rate each stream in each category on a scale from 0 (none) to 10 (high).

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - GMF		Checked By
Date April 1992	Proj. No.	Sheet 1 of 1 Page 4 of 4

Worksheet S6

WASTE STREAM SUMMARY

EPA

Attribute		Description[1]					
		Stream No. 3		Stream No. 3		Stream No.	
Waste ID/Name:		*Spilled Oil/Out dated chemicals*		*Solvent*			
Source/Origin		*Equipment maintenance*		*Equipment maintenance*			
Component/or Property of Concern		*Oil*		*Petroleum naptha*			
Annual Generation Rate (units____)		*Unknown*					
• Overall		*Unknown*					
• Component(s) of Concern				*Flammable*			
Cost of Disposal							
• Unit Cost ($ per:____)		*Unknown*		*$65.75/service*			
• Overall (per year)		*Unknown*		*~$600*			
Method of Management[2]		*Recycle*		*Incineration*			
Priority Rating Criteria[3]	Relative Wt. (W)	Rating (R)	R x W	Rating (R)	R x W	Rating (R)	R x W
Regulatory Compliance		*High*		*High*			
Treatment/Disposal Cost		*Unknown*		*High*			
Potential Liability		*High*		*High*			
Waste Quantity Generated		*Small*		*Low*			
Waste Hazard		*Medium*		*High*			
Safety Hazard		*Medium*		*High*			
Minimization Potential		*High*		*Medium*			
Potential to Remove Bottleneck		*N/A*		*N/A*			
Potential By-product Recovery		*N/A*		*N/A*			
Sum of Priority Rating Scores		*Σ(RxW)*		*Σ(RxW)*		*Σ(RxW)*	
Priority Rank		*High*		*High*			

[1]For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
[2]Rate each stream in each category on a scale from 0 (none) to 10 (high).

APPENDIX B

INFORMATION SOURCES

Appendix B
Information Sources

SOURCES FOR:

Corrugated polypropylene containers

Mills Industries, Inc.
167 Water Street
Laconia, New Hampshire 03246
(603) 528-4217

Paper recycling

Domtar Fiber Products, Inc.
Recycling Division
3241 Walden Avenue
Depew, New York 14043
(716) 681-1560

Modern Recycling Inc.
P.O. Box 209
Model City, NY 14107-0209
(716) 754-8226

Ramcol Fibres Inc.
226 Ohio Street
Buffalo, NY 14204

Plastic pallets

Cadillac Products, Inc.
7000 East 15 Mile Road
Sterling Heights, MI 48311
(313) 264-2525

Pressed wood pallets

Litco International Inc.
1411 Youngstown-Kingsville Road
Vienna, OH 44473-0150
(216) 539-5433

Recycling Assistance

The New York State Office of Recycling Market Development will assist the Postal Service in exploring recycling opportunities. Contact

Garrett Dolan and Jim Gilbert,
Market Development Specialists
NYS Department of Economic Development
Office of Recycling Market Development
111 East Avenue
Rochester, NY 14604
(716) 325-1944

The New York State Department of Environmental Conservation, Division of Solid Waste, Region IX maintains a record of all local recycling programs and their current markets. They can be reached at:

600 Delaware Avenue
Buffalo, NY 14202
(716) 847-4585

APPENDIX C

FACTSHEET

Source Reduction and Recycling Fact Sheet

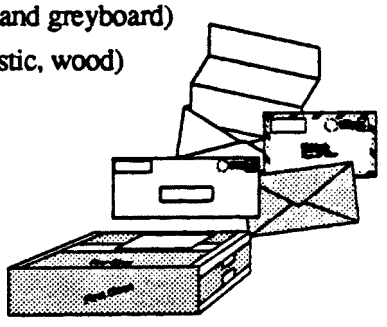
General Mail Facility

WHAT IS THE WASTE PROBLEM?

Every year, each of us produces more than a half ton of solid waste, while business and industry generate an equal amount on our behalf. That's a total of *one ton* of waste per year for every man, woman and child in the United States. A portion of this waste is recycled, a small amount is incinerated, but most, more than 80 percent nationwide, is buried in landfills. Unfortunately, landfill capacity is diminishing while waste generation rates continue to rise.

Mail facilities add to this waste burden by generating large quantities of both hazardous and nonhazardous waste. Typical items in the waste stream include:

- various grades of paper from bulk mailings and general office activities
- cardboard (corrugated and greyboard)
- pallets (fiberboard, plastic, wood)
- newspapers
- magazines
- food service wastes
- oil and solvents from maintenance of machinery and boiler room
- other maintenance wastes: light bulbs, floor sweepings, bathroom cleaning wastes



HOW DOES THIS AFFECT YOU?

Because of the similarity in operations at General Mail Facilities (GMF), waste streams and waste issues are comparable to those found at the Buffalo GMF; therefore, the Buffalo facility is used as a case study to exemplify waste problems and pollution prevention opportunities.

The Buffalo General Mail Facility (GMF) handles more than 1.7 million pieces of incoming mail each day, including 1st and 3rd class letters and flats, and delivers more than 2.8 million pieces of 1st and 3rd class letters and flats to mail recipients. In addition, daily parcel post volume averages 23,866 pieces. By 1995, these volumes are projected to increase by 10 percent. Operations at the GMF include mechanized mail processing, mail distribution, and retail services. Food service is provided by a private contractor.

Most of the solid waste from the Buffalo GMF is buried in landfills in Erie and Niagara Counties. Some of the waste is incinerated, however this incinerator ash is also sent to these landfills. Rising transportation and disposal costs, as well as reduced landfill capacity, make solid waste disposal an important long-term planning issue.

State and municipal legislation will also affect solid waste planning. The New York State Solid Waste Management Act of 1988 requires municipalities to adopt laws or ordinances mandating separation of recyclable or reusable materials from solid waste by no later than September 1, 1992. The City of Buffalo has already adopted a local law which mandates residential, commercial, and institutional recycling. In addition, municipalities are required to meet the state goal of 50 percent reduction, through reuse and recycling of waste by 1997.

To address these waste management issues, the Postal Service is committed to source reduction and recycling as sound environmental practices. Source reduction is a multimedia approach that minimizes or eliminates waste released to land, air, and/or water without simply shifting pollutants from one media to another. The Postal Service considers source reduction to be the most preferred environmental management technique for dealing with a waste generation problem. For those wastes that cannot be reduced at the source, the Postal Service recommends that generators consider recycling as the next best option.

In the Postal Service Waste Reduction Guide (AS 552), the Postal Service set an overall goal to reduce waste 25 percent from 1992 levels by December 1993 and an additional 25 percent by December 1995. Further, the Postal Service plans to reduce the use of the 17 hazardous chemicals that have been identified by EPA's 33/50 Program by 1995.

WHAT CAN YOU DO?

UNITED STATES POSTAL SERVICE

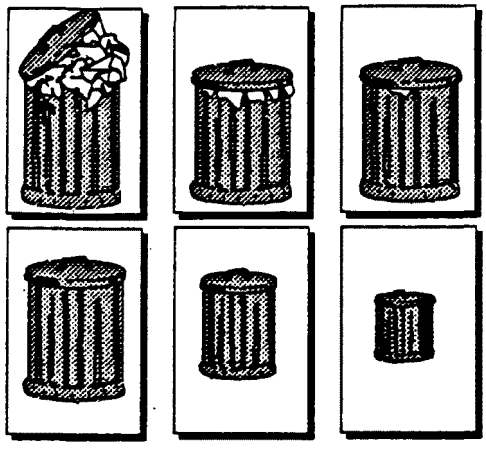
Various options have been identified that may result in the reduction of waste discarded from GMF operations. The following is a brief description of source reduction techniques to consider.

SOURCE REDUCTION

Source reduction reduces the amount of waste or the toxicity of the waste at the source, that is, before the waste is

generated. This can be accomplished through changes in the purchasing and the use and disposal of products and materials. Source reduction includes specifying less packaging or more recyclable packaging, reduced toxicity or increased durability in products, and reduced consumption. These source reduction activities can be accomplished by:

- buying materials in bulk
- specifying reusable packaging
- specifying durability
- avoiding disposable items
- reusing common products (including cups, utensils, and pens)
- using non-toxic cleaning products
- repairing, rather than replacing items
- using double-sided copies and limiting computer printouts



RECYCLING

Recycling recovers a waste from one process and reuses it in the same or in another process in an environmentally safe manner. Recent development of Buffalo area markets for recyclable materials makes recycling efforts more economically feasible for the commercial sector. Some commonly recycled materials in the GMF waste stream include office paper, glass, aluminum, used oil, cardboard, pallets, magazines, and newspapers. By separating cardboard for recycling, the Buffalo GMF has cut the amount of waste by approximately 50 percent and saved $34,000 annually in avoided disposal costs.

Purchasing products made from or containing recovered material or products that can be recycled helps to create and sustain recycling markets. Federal Procurement Guidelines urge Federal agencies to establish an affirmative procurement program for recycled content products or material. Items containing recovered material that can be used at GMFs include office paper, cardboard, plastic, metal, and glass products.

CONSERVATION

Conservation can result in reduced energy and water consumption. An energy audit can identify ways to conserve energy and cut energy expenditures. Some methods of reducing energy consumption include:

- Replacing old bulbs with energy efficient light bulbs
- Installing motion-sensitive lights
- Turning off lights and machines not in use
- Installing programmable thermostats

COMPOSTING

Organic solid waste can decompose under proper conditions to form a useful soil supplement. A composting program can be designed to handle most organic wastes, including food wastes. High quality compost can often be used by businesses for landscaping.

REFERENCES

The following is a list of references that provide additional information on the solid waste problem, and the benefits of source reduction and recycling.

1. *Waste Reduction Guide*, USPS, (AS 552), Feb. 1992
2. *Recycling Guide*, USPS (AS 550), August 1991.
3. *Hazardous Waste Guide*, USPS (AS 553), May 1992.
4. *America Recycles: An Overview*. GSD&M. November 8, 1989.
5. *Managing Solid Waste: Answers for the Foodservice Operator*. National Restaurant Association.
6. *The Municipal Solid Waste Dilemma: Challenges for the 90's*. USEPA, Municipal and Industrial Solid Waste Division, Office of Solid Waste. July 1991.
7. *Decision-Makers Guide to Solid Waste Management*. USEPA, Office of Solid Waste and Emergency Response. November 1989.
8. *Beyond 40 Percent: Record-Setting Recycling and Composting Programs*. Institute for Local Self-Reliance. 1991.
9. *Salvaging the Future: Waste-Based Production*. Institute for Local Self-Reliance. 1989.
10. *Facing America's Trash: What Next for Municipal Solid Waste?* Office of Technology Assessment. October 1989.
11. *The Solid Waste Dilemma: An Agenda for Action*. USEPA, Office of Solid Waste. February 1989.

Funding provided by the United States Environmental Protection Agency and the United States Postal Service

POLLUTION PREVENTION OPPORTUNITY ASSESSMENT

VEHICLE MAINTENANCE FACILITY
UNITED STATES POSTAL SERVICE FACILITY
BUFFALO, NY

by

Science Applications International Corporation
Falls Church, VA
Cincinnati, OH

EPA Contract No. 68-C8-0062
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DISCLAIMER

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ABSTRACT

This report presents the results of a pollution prevention opportunity assessment conducted at the Vehicle Maintenance Facility for the U.S. Postal Service's office in Buffalo, New York. The assessment was performed under Work Assignment 3-54 entitled U.S. Postal Service Operations Pollution Prevention Opportunity Assessment for the U.S. Environmental Protection Agency (EPA) and the United States Postal Service (USPS).

The assessment, conducted during the week of April 6, 1992, followed procedures in the U.S. EPA Waste Minimization Opportunity Assessment Guide (EPA 625/7-88/003). These procedures are encompass the concepts in the U.S. EPA Facility Pollution Prevention Guide and the United State Postal Service Recycling Guide (AS 550) Waste Reduction Guide (AS 552) and Hazardous Waste Guide (AS 553). Technologies and techniques to reduce and recycle hazardous and nonhazardous wastes were evaluated for effectiveness. This report identifies potential source reduction and recycling initiatives and identifies areas where further research is needed.

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ACKNOWLEDGEMENTS

Funding for this project was provided by the United States EPA and the United States Postal Service. The EPA Office of Research and Development Risk Reduction Engineering Laboratory also cooperated and assisted in this project. Special thanks are extended to Jim Rusiniak, Charlie Vidich, Kevin Ferguson, and Mary Bordonaro of the USPS and John Filippelli, Steve Petrucelli, Palma Risler, and Ken Stone of the U.S. EPA.

INTRODUCTION

Background

The Environmental Protection Agency (EPA) Region II has established a regional policy to actively pursue pollution prevention at federal facilities. In response to EPA Region II outreach efforts, the United States Postal Service Northeast Region requested technical assistance to explore ways to reduce the amount of waste generated at the general mail facility and the vehicle maintenance facility located in Buffalo, New York. The United States Postal Service (USPS) is committed to source reduction and recycling as sound environmental practices. USPS policy is to reduce waste and pollutants at the source of generation. Following source reduction, postal priorities for solid and liquid nonhazardous and hazardous waste management are recycling, energy conservation and recovery, waste treatment, and (as a last resort) waste disposal (USPS Waste Reduction Guide, AS 552). The Postal Service's goal is to reduce waste 25 percent from 1992 levels by December 1993 and an additional 25 percent by December 1995. In addition, the Postal Service is committed to reducing by 1995 the use of 17 hazardous chemicals identified by EPA's 33/50 Program. A detailed explanation of pollution prevention and its benefits is presented below. The Postal Service intends to use the results of this study to serve as a model for Postal Service facilities in the Northeast region, and if possible, in other parts of the country as well.

The project was initiated in January, 1992. The assessment team, comprised of SAIC staff, conducted the onsite assessment of the Buffalo facility in March, 1992. An initial briefing was held to acquaint Postal Service officials with the assessment team members, to discuss site visit objectives, and to organize the onsite information gathering process. In addition, the assessment team gave a half day presentation to Postal Service and EPA representatives from the Northeast region. The presentation provided an overview of pollution prevention concepts, waste management issues pertinent to the Postal Service, an explanation of the pollution prevention opportunity assessment process, and a discussion of overall project goals. The assessment team spent three days at the Buffalo facility and viewed the areas where wastes are generated; collected process information; interviewed facility personnel; identified waste management procedures; identified procurement procedures; gathered information concerning waste generation, disposal methods and costs; and local waste handling/reduction programs. A color slide log of the assessment and accompanying text was prepared.

The assessment team continued to collect information by phone after the site visit. The assessment team identified the most significant waste streams based on the quantity of waste generated, chemical constituents, and associated disposal costs. Analysts then identified and evaluated options for waste reduction for each process found at the Buffalo facility using the assessment worksheets completed during the site assessment. Appendix A contains worksheets completed by USPS staff and used in this report. In addition, team members explored several options that could also apply to other Postal Service facilities.

The assessment covered both the general mail facility and the vehicle maintenance facility which are located at the Buffalo Postal Service site. The findings for each of these two facilities are reported separately. This report presents the findings from the assessment of the vehicle maintenance facility. Findings for the general mail facility are found in the report entitled, Pollution Prevention Opportunity Assessment General Mail Facility.

Purpose

The purpose of this project is to conduct a pollution prevention opportunity assessment to identify source reduction and recycling options for both hazardous and nonhazardous wastes generated at the vehicle maintenance facility. This report summarizes the results of the pollution prevention opportunity assessment and explains specific options and their associated costs and benefits. The Postal Service can

use this report as the basis for its pollution prevention implementation plan. Both source reduction and recycling alternatives have been considered for the selected waste streams.

Site Description

The USPS General Mail Facility (GMF) and Vehicle Maintenance Facility (VMF) are located in separate buildings at 1200 William Street, Buffalo, New York, a site encompassing approximately 25 acres. Both facilities were designed and built to USPS specifications. The USPS began leasing the site in 1963 and purchased it in 1979. The VMF is located in a one story building that covers 121,061 gross square feet with 10,100 square feet of office space. The VMF maintains a fleet of 1,200 vehicles. Approximately 734 of the vehicles are city based and the remaining 464 are based in the associated offices. Types of vehicles used by the Postal Service range from light delivery vehicles to tractor trailers. Vehicle maintenance is performed by 32 automotive technicians. Facility working hours are 5:00 am to 11:30 p.m. Monday through Saturday. The major operations are vehicle repair and servicing and painting.

The floor space at the VMF is divided into a five separate areas: 1) an office space area, 2) a storage area, 3) a painting area, 4) a service bay area, and 5) a vehicle power-washing area. The painting, service bay, and vehicle power-washing areas are the sources of the largest volumes of wastes generated at this facility. As a result, this report will focus on these operations at the facility.

PURPOSE AND BENEFITS OF POLLUTION PREVENTION

Prior to developing and implementing a pollution prevention program, it is imperative that USPS employees understand pollution prevention and its components. The following sections describe the goals, concept, and benefits of pollution prevention and the procedure for conducting an opportunity assessment similar to those conducted under this project. The USPS has a series of pollution prevention related guides: Waste Reduction Guide (AS 552), Recycling Guide (AS 550), Stormwater Management Program Guide, and Hazardous Waste Guide (AS 553). These USPS guides contain step by step assessment procedures, suggested pollution prevention best management practices and technologies, and helpful worksheets. They also explain USPS pollution prevention policies and waste reduction goals. A comprehensive USPS facility pollution prevention program will incorporate the policies, plans and programs contained in these USPS documents.

Pollution Prevention - Goals

The ultimate goal of pollution prevention is to reduce present and future threats to human health and the environment. Pollution prevention is any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and any practice which reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants (Pollution Prevention Act of 1990). Pollution prevention is a fundamental shift from treatment of wastes. Source reduction does not include any practice which alters the physical, chemical or biological characteristics of the volume of a hazardous substances, pollutant, or contaminant through a process or activity which itself is not integral to and necessary for the production of a product or the providing of a service.

Pollution prevention is a multimedia approach that minimizes or eliminates pollutants released to land, air, and/or water without shifting pollutants from one media to another. Pollution prevention is accomplished by equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

Pollution prevention is the environmentally preferable option in the waste management hierarchy. Wastes that can not be prevented should be recycled in an environmentally sound manner. Pollutants that cannot be prevented or recycled should be treated in an environmentally safe manner. Disposal or other release into the environment should be utilized only as a last resort and should be performed in an environmentally safe manner.

Recycling is using, reusing, or reclaiming materials/waste, including processes that regenerate a material or recover a usable product from it (USEPA, Facility Pollution Prevention Guide). There are many ways materials can be reused or reclaimed. Reusing products, such as reusable beverage containers, results in decreased purchases of raw materials and reduces pollutants generated from making new products.

Pollution Prevention - Benefits

Facilities gain both direct and indirect benefits by implementing pollution prevention options. The following were presented in the U.S. Postal Service Waste Reduction Guide.

The Postal Service will benefit from waste reduction by:

- Significantly reducing the amount of pollution released to the environment.
- Obtaining reductions faster than might be achieved by waiting for statutes or regulations to take effect and by achieving permanent solutions where source reductions occur.
- Providing the flexibility to choose cost-effective and environmentally sound solutions that will also result in improved efficiency and net economic growth.
- Creating clear expectations in the form of a national goal for targeted chemicals.
- Providing positive incentives through public recognition of its efforts and by working to identify regulatory barriers.
- Saving capital.
- Minimizing paperwork.
- Reducing liability.
- Possibly changing the status of facilities that generate hazardous waste from Large Quantity Generator to Small Quantity or Very Small Quantity Generator status.
- Reducing long-term risks of an uncertain nature and scope–such as the cumulative effects of toxic substances–without waiting for research.

The analyses of source reduction and recycling options in this report focus primarily on the direct benefits to the Buffalo facility in savings in disposal, operational, and procurement costs. However, the indirect benefits of pollution prevention may be equally significant. One indirect benefit is reduced liability. The USPS will lower its liability under RCRA's "cradle to grave" provisions and the provisions of the Federal Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). The RCRA and Superfund "cradle to grave" provisions stipulate that a generator remains responsible for all environmental damage resulting from its waste including damage that occurs after disposal. Even the disposal of small quantities of hazardous wastes to a Superfund site could result in USPS being responsible for costly future

cleanup. Having less hazardous or toxic materials on-site will also mean reduced occupational hazards, and, therefore, improved worker health and safety. A pollution prevention program can generate good will in the community and workplace, enhance the USPS's public image, and foster environmental awareness among employees. By decreasing the amount of hazardous waste shipped offsite for disposal, the USPS may also reduce the costs associated with tracking and filing paper work required for hazardous waste manifests.

Pollution Prevention Opportunity Assessment Procedure

In general, this project follows the EPA procedures outlined in the Waste Minimization Opportunity Assessment Manual (EPA/625/7-88/003) and is consistent with the concepts contained in EPA's Facility Pollution Prevention Guide (EPA/600/R-92/088) and shown in Figure 1. These procedures are consistent with the waste reduction approach contained in the USPS publications Waste Reduction Guide (AS 552), Recycling Guide (AS 550), and Hazardous Waste Guide (AS 553).

Pollution prevention opportunity assessments have four phases: 1) planning and organization, 2) assessment, 3) feasibility analysis, and 4) implementation. During the planning and organization phase, a commitment from management is ensured, overall assessment goals are set, and the assessment program task force is organized. The assessment phase involves quantifying current waste generation and management practices, including collecting process and facility data, setting priorities and selecting assessment targets, selecting assessment team members, reviewing data, generating options, and screening and selecting options for further study. The feasibility analysis phase is a technical and economic evaluation of the selected options. Options are ranked and selected for implementation. The implementation phase puts the options into action. This may require justifying projects and obtaining funding, installing equipment, implementing procedures, and evaluating the performance of each option. This report covers the first three steps and provides the framework for implementation.

PROCESS REVIEW

Approximately 2,500 to 3,000 routine maintenance or unscheduled repair jobs are performed at this vehicle maintenance facility per year. Some of the major operations that take place include:

- vehicle painting (partial and/or touch-up work)
- automotive maintenance, repair, and washing
- fueling

This report will focus on operations at the vehicle painting and automotive repair and washing stations. Fueling operations were not evaluated as part of this assessment due to limited resources and are not discussed in this report.

Painting Operations

The Buffalo VMF painting operation services approximately 1,200 vehicles. Vehicles are inspected every six months to determine if painting and/or body repair work is required. Approximately 700 vehicles per year receive partial or touch-up painting maintenance. In 1991, approximately 500 complete vehicles were painted. The USPS is in the process of replacing, over a three year period, the quarter ton jeeps with Long Life Vehicles (LLVs). Phasing-in the LLVs has increased the number of vehicles requiring a complete paint job. As delivered by the supplier the LLVs are equipped with a coat of primer paint. At the VMF they

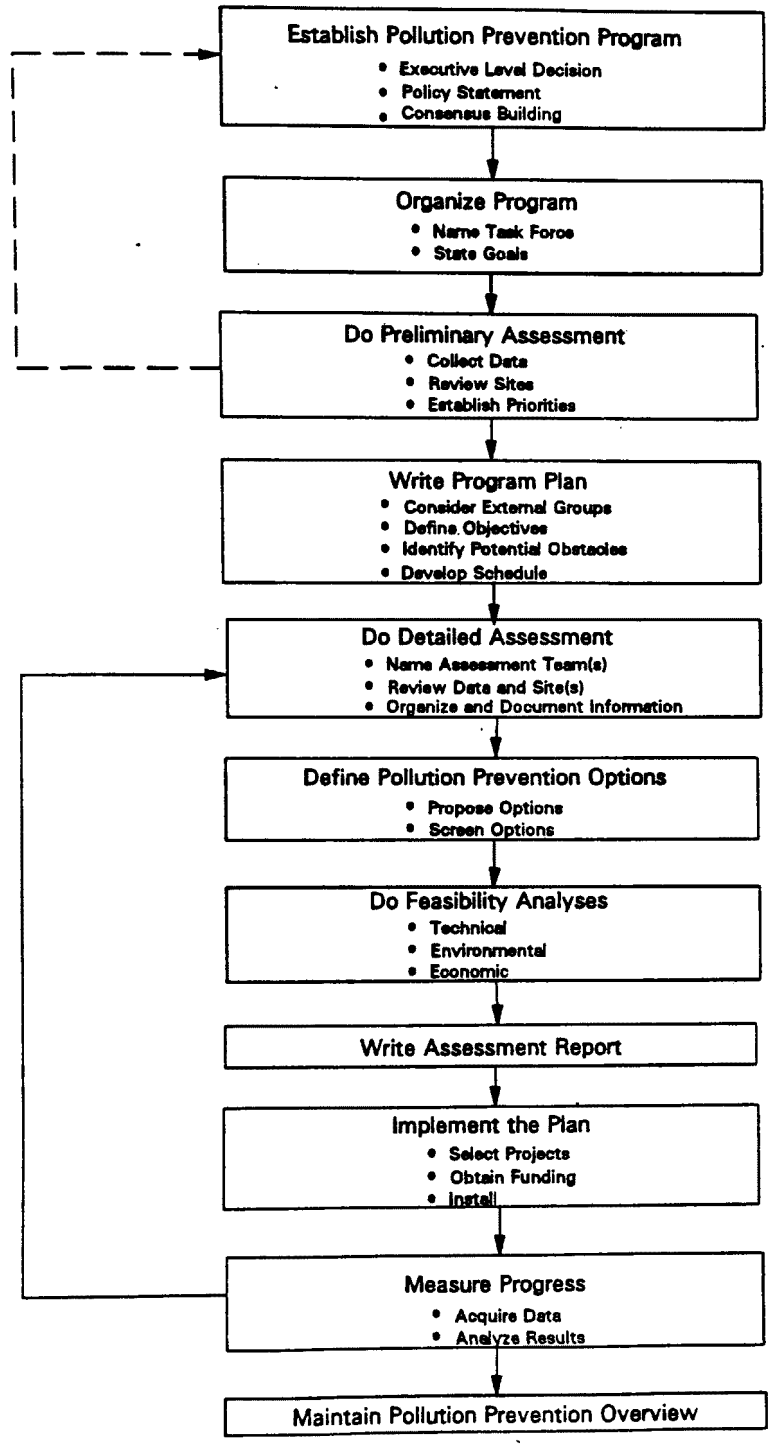


Figure 1. Pollution Prevention Assessment Procedure.
Source: EPA Facility Pollution Prevention Guide (EPA/600/R-92/088)

are painted Postal Service colors. As the phase-in is completed the number of vehicles requiring an entire paint job is expected to decrease. The long term impact on the number of vehicles requiring painting is uncertain. On average the jeeps were repainted every three years. If the LLV paint is more durable they may not have to be painted as frequently.

Materials and equipment frequently used and purchased by the USPS to maintain their painting operations include: four or five different colors of paint; solvents for paint thinning; a spray gun to apply the paint; a sander to prepare an area of the vehicle for painting; lacquer thinner to clean spray guns used to apply paint to vehicles; solvents for cleaning; paint equipment; paint filters; and masking paper, used to protect areas of the vehicle not intended for painting.

Vehicle painting has several steps. First, vehicles are visually inspected and, if necessary, a solvent degreaser is applied by hand to remove any oil or grease from the area to be painted. Secondly, the area is sanded using a sand-vac and lightly polished. Finally, the area is primed and painted. Most body work (i.e., dent and collision damage repair) is performed offsite by a contractor, small jobs are performed at the VMF. Best professional judgement is used to determine the amount of paint mixed for each job. Four to five colors are used: gray for primer, black, off-white or beige (for LLVs), and white. Paint is applied using an airless spray gun system (Sharpe Model 479). Paint guns are cleaned with lacquer thinner in a solvent sink.

Automotive Maintenance and Repair Operations

Automotive maintenance and repair operations include routine scheduled maintenance as well as unscheduled repairs. USPS directives determine a vehicle's maintenance needs based on the vehicle's mileage. (Selected USPS directives were reviewed by the assessment team and the fluid replacement schedule appeared to be reasonable). At scheduled intervals, each vehicle is sent to the VMF for a maintenance that may include oil changes, check-ups and additions of other fluids (e.g., transmission, brake, and antifreeze), carburetor cleaning, as well as replacement of worn or broken parts (e.g., batteries, shock absorbers, radiators, tires, mufflers, electrical components, or windshields).

In addition to repairs and tune-ups, Postal Service vehicles are washed to maintain the cleanliness of the fleet. Vehicle washing takes place in three locations. Mail delivery vehicles (LLVs and jeeps) and small and medium sized trucks are washed in an industrial vehicle washing station located in a covered area next to the VMF building. A power washer (Graco brand) located in the VMF area is used to wash vehicles prior to their being repaired, and to clean large parts. Large trucks are washed in the VMF parking lot by a commercial vehicle washing firm.

Frequently used materials and equipment at the VMF include: engine oil and oil filters; transmission fluid; brake fluid; antifreeze; carburetor cleaner; cleaning solvents; as well as parts such as batteries, shock absorbers, brakes, radiators, tires, tire rims, mufflers, electrical components, and windshields. In addition small amounts of adhesives and epoxies, and cleaning compounds (for the power washer), are also purchased. Petroleum naphtha solvent is used for cleaning engine parts. Brake parts are cleaned in an organic solvent. Both engine and brake parts are cleaned in solvent sinks or parts washers. There are four engine parts washers and three brake parts washers onsite.

SUMMARY OF VMF WASTE GENERATION

Determining the composition and quantity of wastes provides a baseline description of waste type, quantity, and waste management costs. This baseline information is used to identify the major wastes and evaluate source reduction and recycling opportunities. To assess waste generation from the VMF, the assessment team reviewed assessment worksheets, hazardous waste manifests, and interviewed Postal Service employees. Prior to the site visit, Postal Service employees were provided with assessment

worksheets to record raw material inputs, hazardous and nonhazardous waste quantities generated, disposal methods and costs (see Appendix A). Information used for this report was based on hazardous waste manifests covering a three month period, from January to March, 1992. According the USPS employees this three month period represents typical waste generation rates and management costs at the VMF. These records were used to estimate annual waste generation rates and costs. Although incomplete, the worksheets and hazardous waste manifests were the most accurate source of information available that described waste quantities and disposal costs at this facility. Nonhazardous solid waste, such as cardboard, plastic, paper, and glass, are generated at the VMF. Disposing of these wastes from the VMF are paid for as part of the overall General Mail Facility disposal costs. A discussion of the quantities and management costs as well as pollution prevention options for these wastes are found in the companion report Pollution Prevention Opportunity Assessment General Mail Facility. Painting and maintenance and repair operations at the VMF use several types of hazardous material, and generate a number of hazardous wastes.

The Postal Service has voluntarily committed to reducing their emissions of the seventeen toxic chemicals targeted under the U.S. EPA 33/50 Program. Five 33/50 Program chemicals are used by USPS in the VMF. Of these, four are found in paints used by the USPS painting operations (toluene, xylene, methyl ethyl ketone, and methyl isobutyl ketone). Lead is contained in lead acid batteries and radiators. The 33/50 Program is EPA's voluntary pollution prevention initiative to reduce national pollution releases and off-site transfers of 17 toxic chemicals by 33 percent by the end of 1992 and 50 percent by the end of 1995. The Agency is inviting companies to participate by examining their own industrial processes to identify and implement pollution prevention practices for these chemicals. The Program aims to reduce releases and off-site transfers of a targeted set of 17 chemicals from a national total of 1.4 billion pounds in 1988 to 700 million pounds by 1995, a 50 percent overall reduction. In addition to the 17 target chemicals listed below, EPA also encourages companies to reduce releases of other pollutants.

- Benzene
- Cadmium and Compounds
- Carbon Tetrachloride
- Chloroform
- Chromium and Compounds
- Cyanide and Compounds
- Lead and Compounds
- Mercury and Compounds
- Methylene Chloride
- Methyl Ethyl Ketone
- Methyl Isobutyl Ketone
- Nickel and Compounds
- Tetrachloroethylene
- Toluene
- 1,1,1-Trichloroethane
- Trichloroethylene
- Xylenes

Painting Operations

RCRA hazardous wastes generated from painting operations include waste paint, paint thinner, and paint equipment cleanup solvent. The Postal Service contracts with a commercial service that leases and maintains the solvent sink used to clean painting equipment. The company removes spent solvent and waste paint, and replenishes the sinks with fresh solvent at scheduled intervals.

Paint is applied with an airless spray gun. Approximately 70 percent of the sprayed paint is lost due to overspray, bounce back or atmospheric emissions. The painting area is periodically swept to remove overspray paint solids which have accumulated on the floor. The paint solids are disposed of in the trash. Atmospheric emissions from painting (i.e., the evaporation of volatile organic compounds (VOCs) contained

in the paint and cleaning solvents) are collected and filtered by the ventilation system and emitted to the atmosphere. The paints used in the VMF are formulated with approximately five pounds of VOC per gallon. The majority of these VOCs are lost during the spraying operation and as the paint is dried. Nonhazardous wastes from painting operations include paint cans, aerosol cans, masking tape, and paint filters.

Automotive Maintenance and Repair Operations

Automotive maintenance and repair operations generate a variety of RCRA hazardous wastes; used oil and filters (transmission, brake fluid, engine oil), antifreeze, lead acid batteries, and soiled absorbent (cracked corn). Waste oil is stored onsite and periodically removed by a commercial service that re-refines the oils and sells them back to the Postal Service. Oil filters are drained and shipped offsite to a commercial waste hauler. Used antifreeze is stored onsite and disposed of as a hazardous waste. Batteries are sent offsite to a battery reclaiming operation. Small spills of engine fluids or other liquids are absorbed using cracked corn which is removed by a commercial waste management service.

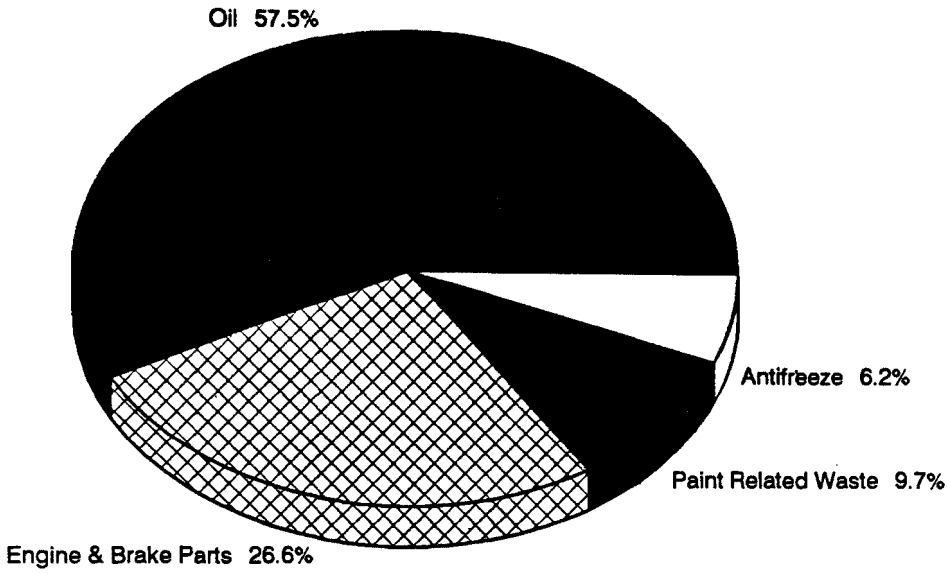
Used solvents from cleaning engine and brake parts are characteristic RCRA hazardous wastes. The Postal Service contracts with a commercial service that leases and maintains the solvent sinks, removes spent solvent, and replenishes the sinks with fresh solvent at scheduled intervals. The shop floor is periodically hosed down with water or cleaned with a commercial floor scrubbing machine. Floor washwater is disposed of down floor drains to an oil and water separator and then discharged to the sanitary sewer. Sludge from the oil and water separator is periodically removed and disposed of as a hazardous waste.

A number of different nonhazardous wastes are also generated. Non-repairable equipment such as brakes, shocks, radiators, tires, tire rims, mufflers, electrical components, and windshields are removed and replaced. Metal parts such as wheel rims and mufflers are collected and sent to a metals recycler. Tires are sent to a tire shredding operation. Large truck tires are sent to a tire retreader and sold back to the USPS. Repairable parts such as brake calipers/rotors/drums, alternators, fuel pumps, carburetors, and power train components are removed and replaced. The broken parts are sold to a commercial service that rebuilds or repairs the equipment and sells the restored equipment back to the USPS.

Table 1 presents estimated solid waste quantities of some of the wastes generated, by waste type. Figure 2 presents estimated volume of liquid hazardous waste generated at the Buffalo VMF. Figure 3 estimates annual solid and hazardous waste management costs. A detailed break-down of each wastestream including quantity generated, management method, annual disposal cost and the source of the data is found in Appendix B. Table 1, Figures 2 and 3, and Appendix B are based on information obtained from the worksheets described earlier, supplemented by interviews and waste manifest data.

TABLE 1. ESTIMATED ANNUAL SOLID WASTE GENERATED
FROM VEHICLE MAINTENANCE OPERATIONS
USPS BUFFALO, NEW YORK

Waste Type	Annual Quantity
Oil Filters	1,374 lbs or approximately 1,800 filters
Lead Acid Batteries	280 batteries
Brakes	1,200 - 1,500 sets
Cracked Corn Absorbent	30-60 gallons
Soiled Rags	8,515 rags
Radiators	280 radiators



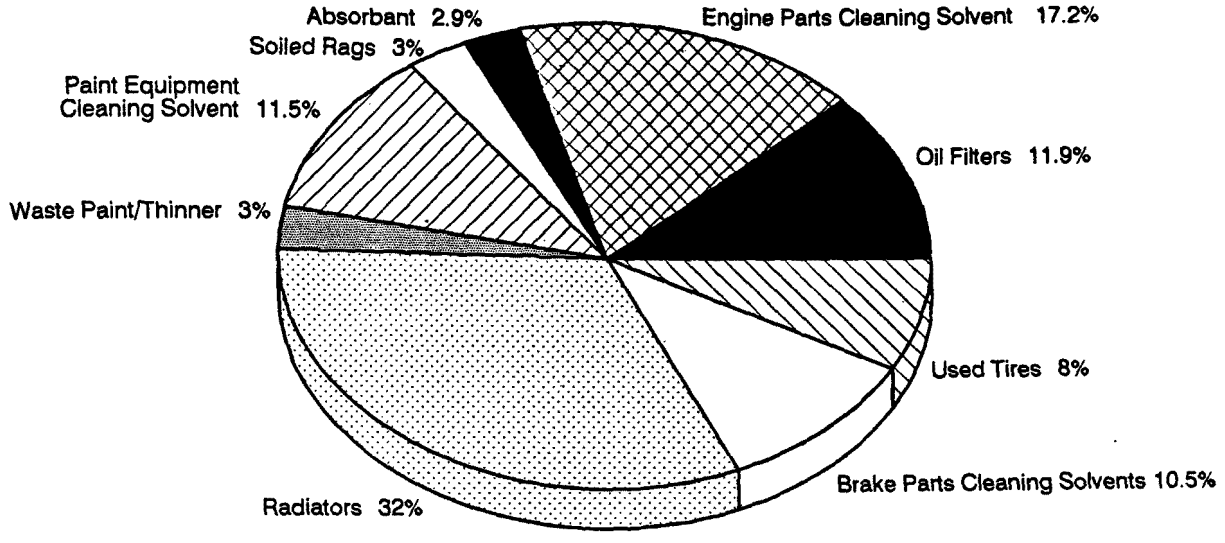
Total 4,917 gal/year

WASTE TYPE	GENERATING AREA	WASTE VOLUME (GAL/YR)
Used Antifreeze	Service Bays	300
Used Oil (engine, brake fluid, transmission fluid)	Service Bays	2,830
Engine Parts Cleaning Solvent[1]	Service Bays	957
Brake Parts Cleaning Solvent[1]	Service Bays	351
Painting Equipment Cleanup - Solvent [2]	Painting	202
Waste Paint/Thinner[3]	Painting	277

Notes:

1. Assumes 1 gallon of waste solvent equals 6 lbs.
2. Assumes 1 gallon of waste solvent equals 5.5 lbs.
3. Assumes 1 gallon of waste solvent equals 5 lbs.

Figure 2. Estimated Liquid Hazardous Waste Generation.
USPS Buffalo VMF 1991



Total $21,645/year

WASTE[1]	ANNUAL DISPOSAL COSTS[2]
Paint Equipment Cleaner Solvent[3]	$2,496
Waste Paint/Thinner[3]	$ 592
Engine Parts Cleaning Solvents[3]	$3,744
Brake Parts Cleaning Solvents[3]	$2,262
Soiled Rags	$ 596
Absorbent Cracked Corn	$ 590
Radiators	$7,000
Oil Filters	$2,565
Used Tires	$1,800

Notes:

1. The following waste streams are not included in the table because the VMF does not pay for disposal: batteries, antifreeze, brakes, oil
2. Sources of data include USPS and waste manifests.
3. Costs include solvent, servicing, and disposal.

Figure 3. Estimated Annual Solid and Hazardous Waste Management Costs.

OPTIONS ASSESSMENT

The Buffalo VMF employees have undertaken or will enact in the near future a number of source reduction and recycling activities. These practices are briefly described. The assessment identified additional pollution prevention opportunities that build upon and expand the current pollution prevention activities. The specific opportunities are also discussed.

Existing Pollution Prevention Practices

The VMF painting staff already have a number of good operating practices to minimize equipment cleanup wastes. Separate paint cups are used for the different color paints. Additionally, the technician schedules painting so that vehicles requiring lighter color paint are painted before those requiring darker paint. He scrapes out the paint cup and collects unused paint for reuse prior to cleaning the equipment in the solvent sink. Other existing pollution prevention practices are:

- Excess paint is saved in one gallon containers and reused on the next appropriate job.
- Parts washing takes place in a solvent sink. The sink recirculates "dirty" solvent to give the paint spray gun an initial rinse prior to a final rinse with clean solvent. The spent cleaning solvent is recycled offsite by a commercial waste management firm.

Automotive Maintenance and Repair

The automotive repair and maintenance operation also implements a variety of important pollution prevention measures. As a result of the assessment site visit and preliminary findings the VMF staff have determined that they can reduce the number of engine and brake parts washers by three to four units. Assuming the frequency of pickups does not increase for the remaining parts washers this will significantly reduce hazardous waste generation. Additional pollution prevention activities include:

- Purchasing re-refined engine oil for use in all vehicles.
- Sending used tires to a tire recycler and purchasing retread tires for trucks.
- Sending repairable parts such as generators offsite to be rebuilt.
- Eliminating methylene chloride in brake cleaner solutions and chlorinated solvents in parts cleaners.
- Using recirculating solvent sinks to reduce solvent use.
- Recycling spent brake cleaning solvent and parts cleaning solvent offsite.
- Collecting used oil (brake fluid, transmission fluid, engine oil) for offsite recovery (re-refining or incineration for energy recovery).
- Recycling batteries through an outside contractor who recovers the lead and acid.
- Recycling metal parts, such as wheel rims, by sending them to a smelter.

Recommended Source Reduction and Recycling Options

The assessment team identified additional options for reducing or eliminating wastes for both the painting operation and the maintenance and repair operations. Pollution prevention options for cardboard, office paper, and glass are discussed in the companion report Pollution Prevention Opportunity Assessment General Mail Facility. The focus of this section is on reducing hazardous wastes.

Options

Painting Operations Waste:

- Low VOC Paints, (water borne or high solids coatings)
- High Volume Low Pressure (HVLP) Paint Application System
- Paint Mixer System
- Gun Washer Station
- Operator Training
- Paint Can Reduction and Recycling
- Buffing Pad Cleaner
- Onsite Solvent Distillation and Recycling

Automotive Maintenance and Repair Waste:

- Use of Aqueous Parts and Brake Cleaner
- Good Operating Practices for Parts Cleaning
- Onsite Solvent Distillation and Recycling
- Onsite Antifreeze Recycling
- Inventory Control and Better Housekeeping
- Improved Waste Management Cost Tracking
- Employee Participation in Pollution Prevention

Options for Painting Operations

Paint wastes account for approximately 11.8 percent of the total liquid hazardous waste generated at the VMF and approximately half the hazardous waste management costs. Major hazardous wastes from paint application are paint, equipment cleaning solvents and VOC (volatile organic compounds) emissions. VMF facilities have two major options for reducing painting-related waste. First, switch to low VOC emitting coatings such as water borne paints. Second, use high transfer efficiency delivery systems, such as a HVLP

spray gun, to reduce the amount of paint required for completing the job. Water borne coatings and HVLP spray system can significantly reduce both VOC emissions and liquid hazardous waste generation from the Buffalo VMF operations.

The Clean Air Act amendments will impose stronger VOC emissions standards on industry. As a result facilities performing automotive painting will have to pay closer attention to their associated VOC emissions. Many states such as California and New York have begun establishing VOC emissions levels for paints used in auto refinishing. New York State expects to promulgate regulations in November, 1992 setting the VOC emissions level for entire vehicle painting jobs at 5 lbs/gal and VOC emissions for touch-up repair work at 6.2 lbs/gal. The emission standard for New York City is currently 5 lbs/gal. (New York State Department of Environmental Conservation, Bureau of Air Resources. Ms. Toni Norfleet in conversation with Dina Li (SAIC-July 9, 1992). Switching to water borne coatings and using a HVLP system will significantly reduce VOC emissions from the Buffalo VMF painting operations.

Low VOC Paints (Water Borne and High Solids Coatings)

There are a number of alternative low VOC emitting paints or coatings available. These include water-borne electrocoating, water borne non-electrocoating, two component high solids, single component high-solids, and isocyanate free paint. A recent article in Products Finishing magazine reviewed these coatings and is enclosed in Appendix C. Water borne non-electrocoating coatings are most compatible with VMF operations and offer the USPS the greatest opportunity to significantly eliminate paint related hazardous waste.

Water borne coatings are formulated with water versus organic solvents. The average solvent based coating such as that used at the Buffalo VMF contains 5-6 pounds of solvent per gallon. Water borne coatings contain between 0.5 to 3.4 pounds of solvent per gallon. Use of water borne coatings significantly reduces VOC emissions. Water borne coatings clean up with soap and water, totally eliminating organic solvent clean up waste.

High Volume Low Pressure (HVLP) Paint Application System

HVLP spray guns use a high volume of air delivered at low pressure to atomize paint. Conventional air assisted guns propel paint from 35 - 80 psi, in contrast, the HVLP guns run at 8 - 10 psi. The decrease in pressure results in significantly reduced paint loss due to bounce-back and overspray. HVLP guns and other high transfer efficiency equipment reduce raw material costs since less paint is needed to cover the same area. Higher transfer efficiency equipment also improves product quality because visibility in the spray booth is clearer. In addition, the decrease in over-spray leads to cost savings in terms of less frequent filter changes and faster booth clean-up.

Paint Mixer System

The amount of paint needed for a job and the mixture of paint thinner to paint is presently measured by the painter using best professional judgement. Depending on the painter's experience this can result in improperly formulated paint and/or left over or surplus paint. Commercially available paint mixers accurately measure and weigh the amount of paint that needs to be mixed according to manufacturers specifications.

Gun Washer Station

Spray guns and equipment are currently washed by hand in an open solvent sink. Dirty solvent is used for initial cleaning followed by a final flush with fresh solvent. The operator controls the amount of solvent used. Gun washer stations are enclosed sinks with specially designed mounting stations for holding spray guns, cups and lids, hoses, pots and other accessories. The primary advantages to using a gun

washer station instead of manually cleaning the guns in a parts washer sink are a substantial reduction in solvent use, lower time and labor costs, and a reduction in occupational hazard and VOC emissions.

Operator Training

In-house operator training can reduce paint wasted due to poor spraying technique. Proper spray technique achieves a 50 percent overlap in paint coverage. Over spray from air assisted guns is decreased by keeping the air pressure low and the spray gun perpendicular to the surface. Videotaping the operator while he is painting is a valuable training tool.

Paint Can Reduction and Recycling

Paint is presently purchased in quart or gallon metal containers. Empty paint cans are drained and thrown away in the trash. It may be possible to order paint in 5 gallon reusable plastic pails or totes. When empty the pail would be picked up by the supplier. Since the VMF requires a large quantity of a limited number of colors, buying in bulk may prove feasible. Unless the product is likely to dry out or expire before being consumed, the existing paint supplier should be contacted to see if they offer bulk purchases in reusable containers.

It may be possible to recycle empty metal paint cans. In some cases the bottom of the can may have to be cut out to ensure all paint has been removed. The VMF staff should determine whether the smelter at which scrap metal is being recycled will accept empty paint cans as well.

Buffing Pad Cleaner

A simple device is available on the market for cleaning buffing pads used to polish the newly painted vehicles. The buffing pad is strapped into place on top of a machine the size of a ten gallon drum. A rotating disk brushes off the paint dust contained in the pad, which can be re-used rather than disposed of.

Onsite Distillation and Recycling of Paint Related Solvent

This option is discussed in the vehicle maintenance and repair section that follows.

Options for Vehicle Maintenance and Repair Operations

Aqueous Chemicals and Parts Washers

Brakes and engine parts are currently cleaned in seven solvent sinks or parts washers. Parts washers are self-contained baths with recirculating and/or agitated compartments. Solvent recirculates continuously from the solvent drum to the solvent wash tray where the parts are cleaned. Although using solvent sinks helps minimize solvent or cleaning solution use and losses, the diverse problems associated with solvent use dictate that solvents should only be used when no other cleaner is suitable for the job.

Engine and brake parts cleaning is a significant source of hazardous waste. Based on waste production and costs experienced from January through the end of March 1992, 5,746 pounds (957 gallons) of hazardous solvent waste from 4 engine parts cleaning sinks and 2,106 pounds (351 gallons) of solvent waste from 3 brake cleaning sinks are produced annually, at a cost of $3,744 and $2,262 per year, respectively. These charges cover solvent cleaner replacement costs and waste treatment. Solvent sink maintenance and solvent waste disposal costs represent approximately one third of the VMF's total hazardous waste management costs.

The appropriate cleaning option depends on how clean parts need to be. The first option should be mechanical cleaning such as hand brushing. Many parts need only be cleaned to remove dirt and grime to allow the mechanic to visually inspect the part. Other parts require more thorough cleaning. Where possible, aqueous or biodegradable cleaning solutions should be used instead of solvent based compounds to eliminate the hazards associated with solvent degreasing systems. Other parts such as bearings must be extremely clean to ensure top performance. Solvent typically has superior cleaning performance to aqueous cleaners. However, all parts may not need to be super clean. The VMF manager should evaluate how clean parts need to be to see if it is possible to replace some or all of the existing solvent sinks with aqueous parts washers.

The primary advantage of using an aqueous cleaning system is that it reduces the occupational hazard and waste management costs associated with solvent parts cleaning. Aqueous cleaners have been found to be a viable substitute for many parts cleaning operations currently using solvents. These detergents, acids, and alkaline compounds displace the oil rather than dissolving it in organic solvent. A cleaning chemical should be used that readily releases or separates the collected oil. Aqueous cleaning chemicals are used in parts washers that use mechanical cleaning action including ultrasonic, air agitated, pressure circulating pump, or hydraulic action parts washers.

Operating Practices for Parts Cleaning

When no substitute is available for solvent cleaners, emphasis should be placed on minimizing solvent waste generation by:

- Eliminating the need to use the solvent by first determining whether cleaning is necessary and just how clean a part needs to be. Rigorous chemical cleaning should only be performed when parts require it (i.e., bearings, engine internals, etc.). Stationary structural members typically require cleaning only for inspection.

- Minimizing losses associated with inappropriate usage, equipment leaks or spills, and evaporation. These losses can range from 25 to 40 percent of total solvent use. The addition of drip trays to both solvent sinks and hot tanks would help reduce these losses.

- Determine if parts and brake cleaning solvent can be serviced on a less frequent basis. Monitor cleaning activity and test solvents to determine if they are spent. Replace solvent when it is spent rather than based on a scheduled pickup.

Since the majority of the wastes coating engine parts are removed during the initial exposure of a part to the wash solutions, a two stage cleaning operation using two washing devices in series may be used to reduce the time needed to clean a heavily soiled part while maximizing solvent potential.

Onsite Solvent Distillation and Recycling

In the event the USPS continues to use solvent borne paints and solvent parts cleaning solutions, an on-site distillation unit is a possible method to reduce solvent waste. Paint and paint related wastes total 479 gallons per year, solvent parts cleaning wastes total 1,308 gallons per year. The annual disposal cost for paint wastes and solvents is $9,094. Avoided disposal costs and a reduction in new product purchase costs make distillation an attractive alternative. Four types of liquid wastes are amendable to onsite recycling at the VMF: paints, thinners, petroleum naphtha, and the brake cleaning solvent. These materials would be distilled onsite and reused. Distillation would be done in batches, e.g., paint related waste would

be distilled separately from petroleum naphtha. Distilled paint related waste can be used as paint thinner and or paint equipment clean up. Distilled petroleum naphtha and brake cleaning solvents would be reused for parts cleaning.

Onsite Antifreeze Recycling

Engine coolant is a mixture of 50 percent ethylene glycol and 50 percent water. As the coolant circulates through the vehicle it gradually becomes contaminated and loses its cooling capacity. Industry is taking a closer look at on-site antifreeze recycling equipment in light of the higher costs of virgin antifreeze and the disposal costs associated with disposing of antifreeze as a hazardous waste. Many local sewer districts no longer accept antifreeze in the sewer system.

The VMF buys 750 gallons of antifreeze per year at a cost of $1500 ($2.00/gal). The Buffalo VMF supplies approximately 450 of the 750 gallons of antifreeze to Associate Offices. Management of used antifreeze is the responsibility of the Associate Office VMF staff. The Buffalo VMF generates approximately 300 gallons of waste antifreeze annually which is managed as a hazardous waste. Recycling antifreeze onsite is an option to reduce waste antifreeze and raw material costs.

Inventory Control and Better Housekeeping

Strict inventory control procedures can reduce waste caused by expired materials, spills and over-stocking. The following steps are recommended:

- Designate one employee as the Supply Manager (the Parts Manager is a typical choice) responsible for approving and ordering materials. The Supply Manager checks the existing inventory to make sure that the item is not still in stock.
- Control access to the supply room by only allowing the Supply Manager to distribute the supplies to the technicians.
- Keep liquid stock on the lower shelves to minimize contamination of other stock and product loss from accidental falls.
- Clearly label all unmarked containers with their contents and expiration date.
- Distribute stock by giving out the oldest material first.
- When possible, buy in bulk (e.g., antifreeze) and pour materials into smaller containers for use in the shop using careful transfer procedures. All containers and drums should have self-closing, non-leak, safety spigots for easy distribution and spill prevention.
- Perform routine storage area inspections.
- Train technicians to maintain the smallest amount of hazardous materials in their work areas.
- Use dirty rags instead of cracked corn absorbent to clean up small spills and drips.
- Employees should be trained in proper spill prevention and control techniques so they know how to prevent spills as well as contain them. Spill kits should be located in areas where spills have occurred in the past.

USPS employees should know the location of spill prevention kits and how to properly use them.

- Where possible, all containers dispensing hazardous materials should be fitted with self-closing, safety valves. Waste oil receptacles and other collection devices should be used to collect drips.

Improved Waste Management Cost Tracking

Designating a separate account number for hazardous and solid waste management costs would improve the USPS's ability to identify and track waste management costs. Under the present system waste management costs are folded into the overall VMF service account. This makes it difficult to identify and track waste management costs. Designating a specific account number for waste management costs has a number of benefits. It would allow the USPS to more easily monitor waste management costs over time. Sudden or gradual increases in waste management costs could signal changes in waste generation operations or improper waste management practices that should be investigated. USPS staff could associate waste management costs with individual operations or departments. The USPS should also consider apportioning or "charging" waste management costs to the department generating the wastes. Making each department aware of and responsible for waste management costs adds an additional incentive to taking steps to reduce waste.

More focused waste management cost accounting also supports the tracking of economic impacts of waste reduction options on waste management costs. Waste management is often a hidden cost. By explicitly identifying these costs, facilities can weigh the costs and benefits of different waste reduction options and, more importantly, quantify savings or losses from instituted waste reduction techniques.

Employee Participation in Pollution Prevention

Active support and participation by all USPS employees is critical to the VMFs pollution prevention program. Implementing the recommendations presented in this report hinges on employee commitment. A major factor in implementing and sustaining source reduction and recycling efforts is employee education. USPS staff need to understand why pollution prevention is important and how they can help. Management must communicate pollution prevention goals and activities and find avenues to solicit worker input on ways to improve the program.

Establishing and maintaining a successful source reduction and recycling program requires constant effort and monitoring. A proactive training program and open communication can help ensure proper performance. Table 2 lists key ways to maintain and improve a pollution prevention program. Appendix D contains a factsheet about pollution prevention at USPS VMFs. This factsheet provides USPS employees with information on how to reduce or recycle wastes from GMF operations.

Pollution Prevention Resources and Training Opportunities in 1992 (EPA/560/8-92-002) is an extremely helpful document that provides guidance on successful employee involvement and training. It is an annual guide containing information about publicly-sponsored pollution prevention resources and training opportunities available across the U.S. It's goal is to provide a single source of pollution prevention options to those interested in learning more about such strategies.

The document contains information such as 1) available training courses or contacts who are willing to share experiences about establishing new training opportunities, 2) availability of pollution prevention publications and videos, 3) Federal and State contacts, 4) availability of university research and training, and 5) Federal, State, and nonprofit organizations that can provide additional pollution prevention information and technical assistance. Additional information can be obtained by accessing the Pollution Prevention Information Clearinghouse (PPIC), which offers a wide range of free information services.

Complimentary copies of the manual as well as additional information on the PPIC can be obtained by calling the Pollution Prevention Information Clearinghouse Hotline at (703) 821-4800 or writing to:

Pollution Prevention Information Clearinghouse
Technical Information Service
c/o Science Applications International Corporation
7600 A Leesburg Pike
Falls Church, VA 22043.

TABLE 2. KEY WAYS TO MAINTAIN AND IMPROVE A POLLUTION PREVENTION PROGRAM

General Goals	Specific Methods
Integrate pollution prevention into corporate planning	Assign pollution prevention accountability to the operating units where waste is generated
	Track and report program status
	Conduct an annual program evaluation at the corporate level
Provide ongoing staff education programs	Make pollution prevention awareness program a part of new employee orientation
	Provide advanced training
	Retrain supervisors and employees
Maintain internal communication	Encourage two-way communication between employees and management
	Solicit employees' pollution prevention suggestions
	Follow-up on suggestions
Reward personnel for their success in pollution prevention	Cite accomplishment in performance reviews
	Recognize individual and group contributions
	Grant material rewards
	Consider pollution prevention a job responsibility subject to review
Provide public outreach and education about pollution prevention efforts	Submit process releases on innovations to local media and to industry journals read by prospective clients
	Arrange for employees to speak publicly about pollution prevention measures in schools and civic organizations.

Source: Facility Pollution Prevention Guide (EPA May 1992)

Additional Options

The following options were considered but were not evaluated further due to poor economics, technical limitations, or ongoing research within the USPS. A brief discussion of each follows.

- Recycle vehicle wash water
- Fuel and oil additives or treatments such as synthetic oil
- Long life oil filters
- Recyclable air filters
- Alternative fuels (solar, natural gas, electric)
- Alternative vehicle body materials

The option of recycling wash water from the power washer was not evaluated further given the high capital cost and long payback period. The long payback period is due to the very low water and sewer fees paid by the USPS. The cost feasibility calculations for a washwater recycling system are shown in Appendix E.

The USPS Engineering and Development Center is researching and testing engine performance enhancing materials, long life oil filters, and recyclable air filters. Additionally, Fleet Management Bulletin No. V-08-87 prohibits the testing of fuel and oil additives and treatments or other energy saving devices and additives at the local level without prior approval of the USPS Office of Fleet Management. The USPS is actively researching alternative fuels. Ongoing USPS research and the national implications of these options make it more appropriate that they be researched at higher USPS levels.

Painting operations are a major source of hazardous waste at the VMF. A possible option to reducing or eliminating painting might be alternative vehicle body materials such as fiberglass or other non-metal materials that are impregnated with pigment. As the vehicle ages the material would wear down exposing a new layer of paint. This may eliminate the need to routinely repaint vehicles. Issues such as choosing and testing alternative vehicle body materials are more appropriately researched at higher levels of the USPS given the highly technical nature of material science and the USPS wide implication of this option.

Options Ranking

Table 3 is a qualitative ranking of selected pollution prevention options discussed in the feasibility section. Each option is judged against a set of criteria. These criteria take into account environmental, economic, and implementation considerations identified from the site visit, interviews with USPS employees and information taken from the worksheets. The ranking system in Table 3 is based on the assumption that each option will have either a positive (more efficient, more cost effective, reduce toxicity), neutral, or negative (more labor intensive, more expensive, incompatible) effect on current operations. Using a system of one through five, with three as a neutral point, each option was ranked. Options with the highest scores have the highest potential to eliminate or reduce wastes and/or waste management costs. Some options were not ranked because they have very low capital costs, the option's benefits are not easily quantified, or the option does not lend itself to the ranking criteria. These include training painters in better spray techniques, improved inventory control and housekeeping, purchase paint in bulk, recycle paint cans, improved parts cleaning procedures, improved waste management cost tracking, and employee incentives.

Table 3. Qualitative Ranking of Selected Options

	Painting Operation				Maintenance and Repair Operations		
Criteria	Water Borne Coating	HVLP Spray Gun	Paint Mixer	Gun Washer Station	Aqueous Parts Washer	Antifreeze Recycling Unit	On-Site Solvent Recycler
Reduction in occupational hazard	5	5	4	5	4	3	3
Reduction of a RCRA regulated waste	5	5	4	4	4	4	4
Reduction of 33/50 Program chemical	5	4	4	4	3	3	4
Reduction of disposal costs	5	5	4	4	4	2	5
Capital cost	4	4	4	3	4	2	2
Implementation	2	3	4	3	2	2	2
Reduction of Environmental Impact	4	4	4	4	4	4	4
TOTAL	34	35	32	32	29	21	28

5 = Very Positive
4 = Positive
3 = Neutral
2 = Negative
1 = Very Negative

These options are included in the implementation plan found in the Implementation Plan section of this document. The criteria used in the table are defined as follows:

- Reduction in occupational hazard: the options are ranked on the basis of whether they would reduce worker exposure to hazardous substances. The antifreeze recycling unit is neutral since workers will still have to handle ethylene glycol.

- Reduction of a RCRA regulated waste: whether the option would eliminate or reduce the generation of a RCRA regulated hazardous waste.

- Reduction of a 33/50 Program chemical: whether the option would eliminate or reduce emissions of one or more of the 17 toxic chemicals targeted by the U.S. EPA though its 33/50 Program. The options were ranked as follows:

  5 = elimination of a 33/50 chemical; 4 = reduction in emission of a 33/50 chemical; 3 = no 33/50 chemical used; 2 = slight increase in a 33/50 chemical emission; 1 = significant increase in a 33/50 chemical emission

- Reduction of disposal costs: whether the option would eliminate or reduce disposal costs.

- Capital cost: the initial impact of capital expenditure necessary for implementing the option.

  The options are ranked as follows:

  5 = zero ; 4 = $0 <--> $1,000; 3 = $1,000 <--> $3,500; 2 = $3,500 <--> $10,000; 1 = > $10,000

- Total annual cost savings: The payback period. Cost savings include operation and maintenance costs and impact on raw material costs. Potential cost savings or avoidance from reduced environmental liability and/or worker health and safety claims are not included.

  The options are ranked as follows:

  5 = > immediate payback; 4 = <1-2 year payback; 3 = no cost difference between current practice; 2 = >3 year payback; 1 = no payback

- Implementation: Factors include barriers (policy, technical, economic), time needed to implement the option including training, and ease of implementation.

- Reduction of environmental impact: net effect of the option on the environment.

5 = elimination of waste and/or emission, very positive environmental impact
4 = reduction in volume of waste and toxicity, positive environmental impact
3 = no change in environmental impact
2 = increase in waste volume and/or toxicity
1 = large increase in waste volume and/or toxicity.

FEASIBILITY ANALYSIS

This section presents a limited technical and economic feasibility assessment for each of the major source reduction and recycling options selected by the assessment team: low VOC paints (water borne coatings); high volume low pressure (HVLP) paint application system; a paint gun washer station; an aqueous chemicals parts washer; an onsite solvent distillation unit; and an onsite antifreeze recycling unit. The discussion includes an overview of each option's current state of technology (i.e. is the technology widely accepted), the capital, operation, and maintenance costs associated with equipment/material change, operational differences (i.e. differences in operating the equipment as compared to the status quo), wastes/emissions reduced/eliminated, new wastes generated and implementation barriers. Figure 3, presented earlier, portrays the estimated annual solid and hazardous waste management costs for the Buffalo VMF. This figure was derived from assessment worksheets, waste manifests, and interviews with USPS employees. A feasibility discussion of each of the major options described above follows.

Low VOC Paints, (Water Borne Coatings)

Replacing solvent borne paints with water borne paint will eliminate hazardous waste solvent paint thinner, and solvent paint. VOC emissions will be significantly reduced. Low VOC coatings are commercially available and have been widely used in some industries. Improvements in the quality and performance of water borne coatings are advancing quickly. Coating manufacturers are engaged in close competition to be the first to produce coatings that help facilities comply with strengthened air pollution regulations. While the technology is improving, water borne coatings do not deliver the high sheen finish demanded by automotive companies and customers. This should not be a limitation to the use of water borne coatings for the Postal Service. The USPS requirements are based more on performance than appearance. Water borne paints reportedly provide equal corrosion resistance and durability to solvent based paints.

Many coatings are used in refinishing and choosing a compatible system of products is complex. Technicians select coatings on the basis of their compatibility with one another and also for their compatibility with stripping products and body filler materials. As a result, automotive refinishers are often reluctant to change their systems. Potential barriers to switching to water based paints depend on the type of coatings applied to the vehicle in the factory as well as limitations involved in the application and drying processes (i.e. temperature requirements).

Water borne coatings cost about the same as the solvent based paints currently used at the Buffalo GMF. Water borne paints can be applied with the same equipment used for solvent borne paints. Longer drying times are a consideration. Water borne paints are reportedly available in an air-dry version. Depending on the specific paint and production schedule a drying oven may be required. Acme Automotive finishes has a complete line of low VOC products on the market. The products air dry in 30 minutes - 16 hours and emit 1.1 - 4.4 lbs/gal of VOCs. Acme Automotive product information is found in Appendix F. Contact information for other companies offering water borne coatings are found in Appendix G. Table 4 provides some specifications for a water borne non-electrostatic coatings.

Water borne paint waste is typically nonhazardous. The major new waste stream will be wash water from paint equipment clean up and excess paint. The wash water can be discharged to the sewer after appropriate pretreatment, typically removal of paint solids. If toxic pigments are used in the paints the solids will have to be disposed of as a hazardous waste. Contact the local sewer authority to determine what washwater or paint treatment is required.

TABLE 4. WATER BORNE NON-ELECTROCOATING

Application:	Dip or spray applied
Resins:	Acrylic latex, halogenated copolymer latex, aqueous urethane, alkyds, modified alkyds, epoxies, polyesters
Bake Temperature:	Air-dry quickly or baked, force dried
Advantages:	Low VOCs, smooth film, corrosion resistance, good adhesion, easy application, clean up, low-cost equipment, non-flammable, fast drying, low toxicity.
Disadvantages:	Need to monitor painting conditions more closely than with solvents, drying time affected by humidity and temperature because water-borne dry more slowly. May also blister when placed in ovens with insufficient flash-off time.
VOCs:	0.5 -3.5 lbs/gal

High Volume Low Pressure (HVLP) Paint Application System

Depending on operator technique, conventional air spray guns may have a transfer efficiency rate of only 25 to 30 percent. For every ten gallons of paint sprayed, up to three to four gallons of paint may be wasted. By comparison, the transfer efficiency of HVLP guns is 65 - 90 percent, so as little as 0.1 - 0.35 gallon may be lost for every gallon applied. One automotive refinisher in the San Diego area reported paint use reductions of over one third with a finish quality of good to excellent. The firm did not experience any operational problems with the equipment, and reported overall operating costs were comparable to conventional air atomized spray systems. Another firm reported that HVLP spray guns achieve a comparable finish when using standard automotive paints, but may leave a "halo" effect when metal flake paints are used. This is not expected to be a problem for Post Office applications since metal flake paints will not be used. Disincentives to switching to HVLP systems include operator training and time to get accustomed to the new spraying technique.

Table 5 demonstrates how coating usage, solid waste, VOC emissions and overspray vary as a function of the transfer efficiency of the spraying equipment. The table was prepared based on VMF purchase records of 600 gallons of paint per year. The formulas for making the calculations are found in Appendix H. Assuming that the VMF's existing gun system achieves a 40 percent transfer efficiency, a relatively high transfer efficiency for this type of equipment, the table illustrates that by switching to the HVLP system with a transfer efficiency of 80 percent, coating usage decreases by 50 percent, solid waste decreases by 30 percent and VOC emissions decrease by 50 percent. Because overspray is reduced from 115.2 gallons per year to 19.2 gallons per year, paint filter usage will decrease by approximately 50 to 80 percent.

TABLE 5. COATING USAGE, SOLID WASTE GENERATION AND VOC EMISSIONS AS A FUNCTION OF TRANSFER EFFICIENCY

	Percent Transfer Efficiency				
Item	20%	40%	60%	80%	100%
Coating Usage					
Coating solids applied (gal/yr)	76.8	76.8	76.8	76.8	76.8
Coating usage (gal/yr) assuming 32% by volume solids	1200	600	400	300	240
Solid Waste Generation					
Coating solids overspray (gal/yr)	307.2	115.2	51.2	19.2	0
Solid waste generated (gal/yr)	1689.5	1267.2	844.8	422.4	0
VOC Emissions (gal/yr)	816	408	272	204	163
VOC Emissions (tons/yr)*	3	1.5	1	.75	.6

Source: Duletsky, Barbara W., David L. Newton. "The Use of Process Modifications in Reducing Industrial Wastes from Spray Coating Operations." 1985 Triangle Conference on Environmental Technology, Raleigh, NC.

Assumptions

- Paint solids content of 32 percent.
- Coating usage is the total amount of paint sprayed at the work piece. Coating solids applied is the amount of solids that are actually transferred to the work piece. Coating usage equals the sum of coating solids applied + coating solids oversprayed + VOC emissions.
- Performance of the VMF's existing spray gun system is estimated to be 40 percent, a relatively high efficiency rate. A high estimate of HVLP performance is 80 percent.
- Assumes 5 lb VOC/gal of coating; 1 gal VOCs = 7.5 lbs

HVLP paint application systems can be considered a mature technology. HVLP equipment is available from several manufacturers. Vendor information is found in Appendix G. One manufacturer, Binks, produces a line of guns that is suitable for most automotive refinishing. This line of spray guns meets the stringent VOC emissions standards of the California South Coast Air Quality Management District. HVLP guns are designed to handle a wide variety of paints including water borne and high-solids paint.

In general, the only equipment modification required is the replacement of the gun head. Some HVLP spray guns may need more equipment modifications than others (e.g., turbine air compressor or new paint cups). HVLP systems include a high-volume air source, a material supply system and special HVLP guns. The major cost is the spray gun head and associated accessories. A representative Binks gun costs

$385 while a conventional air atomized spray gun costs $200. The VMF's existing air source and material supply system may be compatible with a HVLP gun.

The primary operational difference is the increased transfer efficiency. All other parameters of the painting/refinishing process will remain the same. To ensure proper operation HVLP spray guns must be cleaned and maintained more frequently than airless or air-assisted spray guns. The primary advantage of using an HVLP system is a reduction of VOC emissions. A secondary advantage is a 30 percent reduction in paint overspray. Decreased overspray reduces raw material costs since less paint is needed to cover the same area. In addition there is a mass reduction in paint overspray that is collected by paint filters. Thus, the number of paint filters will be reduced. The amount of overspray depositing on the ground to be swept up or washed down the drain with water will also be reduced. No new wastes are generated.

Table 6 presents a cost/benefit analysis for an HVLP paint application system. Note that many of the cost figures and waste quantities are estimates and, thus, the results of the analysis may vary from actual values.

TABLE 6. COST/BENEFIT ANALYSIS: HVLP PAINT APPLICATION SYSTEM

Capital Costs	
Binks Mach 1	$ 385
Installation (labor @ $25/hr)	$ 25
Total Capital Expenditure	$ 410
Operating and Maintenance Costs	
Paint purchase cost 40% (300 gallons/yr)($20.49/gal)	$2,458
Misc. replacement parts	$ 100
Energy requirement (approximately equivalent to existing levels)	none
Labor (approximately equivalent to existing levels)	none
Training (20 hours implementation/start-up cost @ $25.00/hr)	$ 500
Total Annual Operating and Maintenance Costs	$3,058
Avoided Costs	
Purchase cost (less paint is required $12,304.32 - $2,458.80)	$9,845
Paint Filters (half as many filters are needed $2,348 - $1,174)	$1,174
Disposal cost reduction (30% less waste paint is generated)	$ 177
Total Annual Avoided Costs	$11,196
Net Annual Benefit (NAB) = Avoided Costs - O&M	$8,138
Pay Back Period = Capital Costs/NAB	immediate

Assumptions

- Total current paint purchase cost is $12,304 per year for 600.5 gallons of paint.
- Total paint waste and thinner currently generated is 277.3 gallons and costs $592 per year for disposal.

- Paint applied using the existing gun system is approximately 300 gallons with the other 50 percent being lost to overspray and VOC emissions.
- The HVLP system will lose 15 percent as overspray.
- Disposal costs will be approximately 30 percent less due to decreased paint waste.
- 20 hours of training and break-in time is factored in. No formal training is required.
- Avoided potential liability from reduced hazardous waste generation, transport and storage was not quantified but is an additional benefit.

Paint Gun Washer Station

Paint gun washer stations provide a more efficient means of cleaning spray guns and associated painting equipment. HVLP guns require better cleaning than conventional guns and gun washers can make a difference in maintaining their high performance. Several manufacturers have gun washer systems on the market (see Appendix G). Graco, for example, produces three models. The stainless steel version is suitable for aqueous cleaning chemicals, the others are only designed for solvents. The Graco Mini Flo PRO Wash gun washer costs $995. The main advantage offered by the gun washer system over manual washing in an open solvent sink is that the gun washer operates automatically with the lid closed. Other advantages include:

- The parts washer recycles the cleaning medium (solvent or aqueous).
- VOC emissions are reduced as much as 75-90 percent compared to a solvent sink.
- The washing cycle (and, therefore, labor cost) decreases to 30-60 seconds versus 5-20 minutes for manual cleaning.
- The gun washer uses less solvent both because it reduces solvent loss from evaporation and because of the shorter cleaning cycle.
- The spray guns are cleaned more effectively with the gun washer.
- Worker exposure to toxic substances decreases.

Spent solvent can be recycled on-site in a recycling unit or sent off site. Disincentives include costs associated with maintaining the system, purchasing the solvent and contracting with a licensed hazardous waste hauler to manage the spent solvent and the small amount of sludge generated from the system.

Table 7 presents a cost/benefit analysis for purchasing a gun washer station. Note that many of the cost figures and waste quantities are estimates and, thus, the results of the analysis may be slightly inaccurate. It is possible that gun washers can be leased. The VMF manager should contact the contractor servicing the existing solvent sink to inquire whether they offer a gun washer system. The economics of contracted service are often favorable, considering the current on-site labor costs for equipment maintenance and off-site disposal. Often the cost associated with using a solvent service company is less than the combined cost of solvent purchase, tank maintenance, labor, and waste disposal.

TABLE 7. COST/BENEFIT ANALYSIS: GUN WASHER STATION

Capital Costs	
Graco Mini PRO Wash	$ 995
Transportation	$ 100
Miscellaneous parts	$ 100
Total Capital Expenditure	$1,195
Operating and Maintenance Costs	
Operating costs:	
Misc. replacement parts	$ 100
Labor ($25/hr)(32.5 hours = 75% less labor needed)	$ 812
Clean solvent (gal/yr)(solvent can be reused twice before disposal or recycling)(new solvent $8.00 per gallon)	$ 1,400
Disposal costs:	
(270 gallons)($12.35/gal) (assumes 25% lost to evaporation)	$ 3,335
Total Annual Operating and Maintenance Costs	$ 5,647
Avoided Costs	
Purchase cost	
Solvent (360 gal/yr @ $8.00/gal assuming 50% loss due to evaporation)	$ 2,880
Labor cost ($25)(130 hours assuming 30 min a day spent on cleaning)	$ 3,250
Disposal cost (202 gal)($12.35/gal) (actual)	$ 2,495
Total Annual Avoided Costs	$ 8,625
Net Annual Benefit (NAB) = Avoided Costs - O&M	$ 2,978
Pay Back Period = Capital Costs/NAB	immediate

Assumptions

- Actual raw material usage figures are unknown. It was assumed, based on VMF manifests, that 7.7 gallons of solvents are disposed of every two weeks and that total VMF tank capacity is 15 gallons with 50 percent loss due to evaporation.
- Virgin solvents costs $8.00 per gallon.
- 30 minutes a day is spent cleaning the paint gun and equipment after three color changes.

- Disposal cost for the gun washer system is higher than disposal cost for manual cleaning because less solvent has evaporated; assumes 25 percent is loss from the gun washer system, 50 percent from manual cleaning.

- Assumes the contents of the gun washer tank (30 gal) can be used twice before disposal.

Aqueous Chemicals and Parts Washers

A number of equipment manufacturers specialize in designing and distributing cleaning systems utilizing biodegradable aqueous and semi-aqueous cleaners. (See Appendix G.) These units are intended to replace systems using hazardous solvent cleaning materials. Commercially available aqueous cleaning units range from small, single-station dip tanks to completely automated-transfer, multi-stage systems. Spray, agitating, immersion, ultrasonic immersion, or a combination of these processes can be selected to address the VMF's specific applications.

Some companies offer a leasing service for aqueous parts cleaners. These arrangements include equipment leasing and periodic general maintenance service, replacement of spent cleaning solution with fresh cleaning solution and make-up water. The economics of a contracted service are often favorable to purchasing and maintaining a parts washer considering the current on-site labor costs for equipment maintenance and off-site disposal. Often the cost associated with using a service company is less than the combined cost of cleaner solution purchase, tank maintenance, labor, and waste disposal. The purchase price for aqueous cleaning units ranges from $650 to $1,000. Aqueous cleaning chemicals cost around $0.85 per gallon.

The disadvantage to aqueous parts cleaners is that parts are wet after cleaning, increasing the possibility that carbon steel parts will rust. Thus, following rinsing to remove any residual cleaner residue, the parts need to be thoroughly dried. Two additional steps (i.e., rinsing and drying) may be required to clean a part using an aqueous cleaning unit compared to a solvent sink. This corresponds to increased space requirements for additional equipment, longer cleaning times, and potentially higher initial capital costs. A corrosion-preventing inhibitor may also need to be applied during the rinse cycle, or just prior to dry-off, adding expense to the process.

Petroleum naphtha and brake cleaner solvent are hazardous materials and are managed as RCRA hazardous waste. Replacement of solvents with non-toxic aqueous chemicals will eliminate the use of these hazardous solvents. Aqueous cleaners generate three main types of waste: waste water, oily waste, and sludge. Washwater are typically circulated through a filtration system and reused. Additional water and aqueous cleaner are added to the wash water as needed. Periodically the wash water bath is changed. Depending on the aqueous cleaner used, the spent solutions may be flushed down a sanitary sewer leading to a biological treatment facility. The USPS must contact the local sewer authority before disposing of spent aqueous cleaning solutions down the drain. Oily waste is typically managed by separating it from the wash water. The sludge that accumulates in the bottom of the cleaning unit and oil are periodically collected and disposed of as a hazardous waste. Oil, grease, and heavy metals removed from the cleaned parts can concentrate in the sludge requiring the sludge to be managed as a hazardous waste.

Onsite Solvent Distillation and Recycling of Solvents

Onsite solvent distillation units are available on the market and widely used in industry. An article on choosing the correct distillation unit is included in Appendix I. Many companies are marketing solvent recycling equipment (see Appendix I). The average cost runs about $3,500 for a small unit designed for five

to 15 gallons per batch . Other associated costs include the cost of disposing of the small amount of hazardous waste sludge the equipment produces.

Operating an onsite distillation unit may require additional hazardous waste management paper work. Additional labor time will be required for operating and maintaining the unit. Fire and safety considerations must be taken into account when choosing the location of a distillation unit. Onsite distillation units are regulated by New York state law, see 6 NYCRR Part 370.

Table 8 presents a cost/benefit analysis for an on-site solvent recycling unit. Note that many of the cost figures and waste quantities are estimates and, thus, the results of the analysis may be slightly inaccurate. Given the long payback period of 4.5 years, this option is not recommended. If the cost of raw materials or waste disposal increase significantly, this option may be feasible.

TABLE 8. COSTS/BENEFIT ANALYSIS: SOLVENT/THINNER DISTILLATION UNIT

Capital Costs	
LS-JR Unit (GSA Schedule)	$3,700
Transportation	$ 100
Installation (labor @ $25/hr, piping and electrical)	$ 200
Total Capital Expenditure	$4,000
Operating and Maintenance Costs	
Operating costs:	
Heating ($0.10/gal)	$ 130
LS-JR still bags ($19.38/doz)(22 doz/yr)	$ 430
Misc. replacement parts	$ 100
Labor ($25/hr)(260 hrs)	$6,500
Thinner (660 gal)(0.2)($6.36/gal)	$ 839
Disposal costs:	
(1787 gallons)(.20)($10.00/gallon)	$3,574
Total Annual Operating and Maintenance Costs	$12,694
Avoided Costs	
Purchase solvent, service units, waste disposal	
Engine Parts Cleaning Solvent	$3,744
Brake Parts Cleaning Solvent	$2,262
Paint Equipment Cleaning Solvent	$2,496
Waste paint/thinner	$ 592
Total Annual Avoided Costs	$12,452
Net Annual Benefit (NAB) = Avoided Costs - O&M	$ 879
Pay Back Period = Capital Costs/NAB	4.5 years

Assumptions

- Total volume of paint waste/thinner estimated at 277 gallons per year according to manifest records.
- Recycled thinner will replace virgin product by 80 percent. 20 percent virgin thinner will need to be purchased.
- Distillation unit reclaims 80 percent of material, 20 percent of the total waste must be disposed of as hazardous at $10.00 per gallon.
- Actual purchase amounts and costs of the gun cleaner and solvents are not available from the VMF. This assumes conservatively that no material was lost through VOC emissions and uses the amount disposed of as the initial raw material amount.
- Total combined waste disposal of the paint wastes, thinners, gun cleaner and solvents is 1,787 gallons a year according to VMF records.
- For purposes of this analysis, the table assumes that paint wastes, thinners, gun cleaner and solvents from degreasing will all be processed in the recycling unit. In actual practice, however, the waste streams will be recycled separately in the unit rather than in combination.

Onsite Antifreeze Recycling

An onsite antifreeze recycling unit would reduce the amount of hazardous waste (spent antifreeze) generated by the VMF. This would reduce the potential environmental liability of managing these wastes. Concerns about manufacturers invalidating warranties if recycled antifreeze is used have declined. Major U.S. auto makers have begun testing and approving recycling/distillation equipment. In addition, many in the automotive maintenance industry point out that once a vehicle's warranty expires, the warranty issue is moot.

Antifreeze recycling technology has improved over the past few years. There are two types of recycling technologies; filtration systems and distillation systems. Filtration systems rely on a series of fine mesh filters to remove suspended matter from the coolant. The pH is adjusted and new inhibitor (e.g., corrosion prevention) is added to restore the properties of fresh coolant. It may still be necessary to mix in some fresh coolant with the recycled product. The recycling unit generates spent filters which may be a hazardous waste due to metals content. Distillation systems reportedly attain higher levels of cleanliness than filtration systems because distillation removes more of the contaminants particularly the metals. The distillation unit does not generate any additional wastes.

The VMF management annually purchases 300 gallons of antifreeze for use at the Buffalo VMF at a cost of $600 dollars. The waste hauler does not charge the Buffalo VMF for disposal of waste antifreeze. Under these conditions a distillation system is not economically feasible. Although the Buffalo VMF is currently not charged for antifreeze disposal it is conceivable that they will have to pay in the future, making the economics more favorable. Table 9 presents a cost/benefit analysis for an antifreeze distillation unit. Note that many of the cost figures and waste quantities are estimates and, thus, the results of the analysis may be slightly inaccurate.

TABLE 9. COST/BENEFIT ANALYSIS: SMALL ANTIFREEZE RECYCLING UNIT

Capital Costs	
Finish Thompson Inc. Bad Ethyl Coolant Reclaimer	$3,500
Transportation	$ 100
Installation	none
Total Capital Expenditure	$3,600
Operating and Maintenance Costs	
Purchase cost ($2.00/gal)(30 gal assuming 10% fresh antifreeze is added)	$ 60
Treatment cost ($1.87/gal)(300 gal)	$ 561
Disposal cost (.10)(300 gal)(1 drum/50 gal)($150/drum)	$ 90
Total Annual Operating and Maintenance Costs	$ 711
Avoided Costs	
Purchase cost ($2.00/gal)(300 gal)	$ 600
Disposal cost	none
Total Annual Avoided Costs	$ 600
Net Annual Benefit (NAB) = Avoided Costs - O&M	$ -111
Pay Back Period = Capital Costs/NAB	

Assumptions

- This analysis compares the costs associated with an antifreeze recycling unit to the cost of the Postal Service's current purchase and disposal contract with Safety Kleen.
- The recycling unit operating cost of $1.87/gallon for running the antifreeze unit is provided by the manufacturer, Finish Thompson Incorporated and includes electricity, water, and chemical costs for operating a 15 gallon run of 50/50 used coolant.

Potential Barriers

This section outlines potential technical, economic, or institutional barriers to identified options. Table 10 includes a summary of the barriers to implementation. Overall the implementation barriers are relatively modest: there are no major institutional barriers and the capital costs associated with new equipment purchases is relatively low. The major barriers are that some options such as the water borne coatings and aqueous parts washer require further research and testing. In particular the USPS needs to

TABLE 10. POTENTIAL BARRIERS TO POLLUTION PREVENTION OPTIONS

Waste Generating Activity	Waste	Pollution Prevention Option	Potential Barriers to Implementation
Painting	Paint waste	Use water borne paints	Requires further research and testing
		Rigid inventory control to reduce thinner use	Employee attitude and lack of employee training
		Better housekeeping to reduce spills and leaks	Employee attitude and lack of employee training
		Use high transfer efficiency equipment	Capital cost, lack of operator training, adjustment period
		Provide painter training to improve spray technique	Employee attitude and lack of employee training
		Recycle solvent onsite	Capital cost, operation and maintenance, requires further research,and a long payback period (4.5 years)
		Gun washer station to reduce solvents use in gun cleaning	Capital cost
		Paint mixer	Capital cost
	VOC emissions	Use high transfer efficiency equipment	Operator training, adjustment period
		Use water borne coatings	Requires further research and testing
	Booth filters	Use high transfer efficiency equipment	Operator training, adjustment period
	Paint cans	Purchase paint in reusable bulk containers	None
		Recycle used paint cans	Locate recycling market
Maintenance and Repair Parts Cleaning	Solvent/VOC Emissions	Switch to aqueous cleaners	Further research and testing required, capital cost
		Recycle spent solvent onsite	Further research required, capital cost, operation and maintenance
		Better cleaning techniques	Employee training
	Antifreeze	Antifreeze recycling unit	Poor economics (at the present time)
Vehicle/Large Parts Washing	Waste water	Install a wash water recycling system	High capital cost, long or no payback, installation may be difficult
VMF Wide	All wastes	Improved Waste Management Cost Tracking	Employee attitude and lack of employee training

test the alternative coatings compatibility with existing paints and painting equipment; and its performance under a wide range of operating conditions. Prior to replacing solvent parts washers with aqueous washers USPS staff should evaluate its compatibility with existing procedures, waste water treatment issues, and ability to clean parts adequately.

IMPLEMENTATION PLAN

A number of source reduction and recycling options were described. Most of the options complement each other. However, switching to water borne coatings and aqueous parts cleaners will eliminate the need for an onsite solvent distillation unit. Options are grouped based on their ease of implementation and are shown in Table 11.

TABLE 11. IMPLEMENTATION PLAN

Ease of Implementation	Options
Immediate Implementation/Low Barriers	Inventory control and better housekeeping practices
	Contact paint vendor about purchasing paint in reusable bulk containers
	Contact metal recycling firm about feasibility of recycling metal paint cans and aerosol cans
	Painter training to improve spray technique
	Employee training/involvement in pollution prevention
	Improved waste management cost tracking
	Good operating practices for parts cleaning
Intermediate Implementation/Medium Barriers	Water borne paint
	HVLP paint gun
	Paint gun washer
	Paint mixer
Long-Term Implementation/High Barriers	Antifreeze recycling unit
	Recycle solvents onsite

Before purchasing any new equipment, the Postal Service should consult with several suppliers and discuss costs based on a long range assessment of VMF waste generation (i.e., waste records for the last two years should be compiled). New equipment must be tested under a full range of conditions prior to full scale implementation. Suppliers are usually very willing to demonstrate their products at the purchaser's facility.

CONCLUSION

VMF employees have enacted a number of activities to reduce or recycle automotive maintenance and paint operation wastes. These activities included:

- Good operating practices to minimize equipment cleanup wastes during painting operations.
- Excess paint is saved in one gallon containers and reused on the next appropriate job.
- Washing engine and brake parts and painting equipment takes place in solvent sinks. The sink recirculates "dirty" solvent to give the paint spray gun an initial rinse prior to a final rinse with clean solvent. The spent cleaning solvent is recycled offsite by a commercial waste management firm.
- Purchasing re-refined engine oil for use in all vehicles.
- Sending used tires to a tire recycler and purchasing retread tires for trucks.
- Sending repairable parts such as generators offsite to be rebuilt.
- Eliminating methylene chloride in brake cleaner solutions and chlorinated solvents in parts cleaners.
- Using recirculating solvent sinks to reduce solvent use during automotive maintenance and repair.
- Recycling spent brake cleaning solvent and parts cleaning solvent offsite.
- Collecting used oil (brake fluid, transmission fluid, engine oil) for offsite recovery (re-refining or incineration for energy recovery).
- Recycling batteries through an outside contractor who recovers the lead.
- Recycling metal parts, such as wheel rims, by sending them to a smelter.

Based on preliminary assessment findings and recommendations VMF staff reevaluated the number of engine and brake parts cleaning solvent sinks required and determined they can reduce the number by three or four units. Eliminating three or four solvent sinks will reduce the amount of hazardous waste generated by 3,575 to 5,010 pounds and save from $2,626 to $3,562 in operating costs annually (assuming the servicing frequency of the remaining sinks is unchanged).

The USPS has a number of additional opportunities to reduce or eliminate VMF wastes as outlined in this report. Wastes from painting operations and solvent parts washers are the largest hazardous waste source for which source reduction options exist. Source reduction alternatives for the other major hazardous wastes generated at the VMF; engine oil, antifreeze, and lead acid batteries, are not advanced enough to make them viable options at this time. These materials are integral to gasoline powered automobile engineering and design. The shift to alternative fuels ushered in by the Clean Air Act amendments will have a long term impact on the type of vehicles the USPS must maintain and the types

of wastes generated. In the near term, however, the USPS should focus on eliminating hazardous waste from painting and parts cleaning operations.

Water borne coatings and high transfer efficiency paint delivery systems will eliminate or significantly reduce hazardous wastes and VOC emissions from painting operations. Replacing organic cleaning solvents with aqueous parts washers will eliminate hazardous solvent wastes from engine and brake parts washing operations. Enacting these options can potentially reduce hazardous wastes by 5,954 pounds. Table 12 summarizes potential hazardous waste reduction and cost savings for selected options. Implementing these options will assist the Buffalo GMF staff meet the USPS goal to reduce 1992 waste levels by 25 percent by 1993 and an additional 25 percent by 1995. Further, eliminating solvent borne paints will significantly reduce emissions of four EPA 33/50 target chemicals and assist the USPS in meeting its goal of reducing emissions of 33/50 target chemicals by 1995.

TABLE 12. POTENTIAL WASTE REDUCTION AND COST SAVINGS FOR SELECTED OPTIONS (REDUCTIONS ARE COMPARED TO CURRENT PRACTICES)

Option	Annual Waste Reduction Potential	Annual Cost Saving Potential
Water Borne Paints	2,782 lbs of hazardous waste paint/solvent/thinner	$3,088 in reduced waste disposal
Aqueous Parts Washer	3,163 lbs of hazardous engine and brake parts cleaning solvent	Undetermined
HVLP Paint Application System	50% less VOC emissions 30% less paint solid waste	$8,138 in reduced raw material and waste disposal
Gun Washer Station	75-90% less VOC emissions	$2,978 in reduced raw materials and waste disposal

Implementing options identified in this report will not only reduce hazardous wastes, but will also reduce GMF operating costs by decreasing disposal costs. Additionally, there are unquantified benefits such as reduced liability, paper work, spills and spill control/disposal costs, and future regulatory requirements. Reducing hazardous materials/wastes avoids costs associated with cleanups caused by spills of hazardous solvents. Substantial sums of money have been spent at VMFs across the nation to handle accidental spills and releases to the environment. These accidents also involve considerable staff time for completing notices, meeting with regulatory agencies and managing cleanup operations. Postal Service employees reported that the VMF was scheduled to purchase a paint booth, to comply with New York state VOC emission requirements. Prior to purchasing a paint booth the Postal Service should seriously consider replacing solvent borne paints with water borne paint and/or switching to a HVLP paint delivery system. These options together will significantly reduce VOC emissions and eliminate the need for the paint booth. The HVLP system alone has the potential to significantly reduce VOC emission.

There are no major barriers to implementing many of the pollution prevention options. As with all new products the water borne paints and aqueous parts washers will have to researched and tested prior to switching. Recycling antifreeze onsite and operating an onsite solvent distillation unit are not feasible at the Buffalo VMF at present due to the poor economics and long payback periods.

The Buffalo VMF has several characteristics that favor a successful pollution prevention program.

- A core of enthusiastic and committed USPS staff
- Top level commitment to pollution prevention as shown in pollution prevention policies and waste reduction goals
- Buffalo GMF management commitment as shown by their participation in this project
- Adequate quantities of recyclable materials to interest recycling vendors

Applicability to Other VMFs

The USPS operates the largest U.S. civilian vehicle fleet. This has two implications. First, a significant amount of hazardous waste is generated at Postal Service VMFs nationally. The waste management costs and potential environmental liabilities are substantial. The options recommended in this report are directly applicable to the Postal Service's 350 other vehicle maintenance facilities in the United States. Net annual benefits and paybacks should be applicable also.

Secondly, operating and maintaining such a large fleet empowers the USPS with very strong purchasing power. The USPS could specify a preference for purchasing vehicles painted with water borne paints or other low or no VOC technologies. More immediately, the USPS could begin using water borne paints at their vehicle maintenance facilities nationwide. A Postal Service commitment to eliminating solvent based coatings on USPS vehicles will have a significant impact on the Nations coating industries and would provide the incentive for industry to perfect this technology. The Postal Service could work directly with a major coating manufacture to design a water borne coating system to meet USPS requirements. The low number of paint colors used by the USPS should make standardizing coatings simpler.

The USPS should set a minimum transfer efficiency for paint application systems. Given the present state of the industry a transfer efficiency of 75 percent would be reasonable. This level should be reviewed periodically as equipment improves. By specifying a transfer efficiency rather than a specific piece of equipment, such as a HVLP system, the USPS can take advantage of improved technology. Presently the HVLP system is best suited for the type of vehicle painting operations performed at VMFs. However, advancements in other high transfer efficiency delivery systems such as electrostatic, and powder coating, could make these viable technologies for Postal Service use.

Switching to aqueous cleaners can eliminate the use of hazardous solvents and hazardous wastes from cleaning engine and brake parts. However, some aqueous cleaning systems generate RCRA hazardous wastes. Selection of a nonhazardous aqueous cleaning system will require additional research and testing. The USPS could work with industry to test aqueous cleaning systems. Once a system that meets USPS specifications is identified the USPS could set minimum performance standards, or prescribe a certain brand to be used at all VMFs.

APPENDIX A

WORKSHEETS

Firm USPS Site Buffalo, NY - VMF Date March 1992	Waste Minimization Assessment Worksheets Project Number	Prepared By Checked By Sheet __ of __ Page __ of __

Worksheet 1

WASTE SOURCES

EPA

Shop Clean-Up	Significance at Shop		
	Low	Medium	High
Obsolete raw materials		✓	
Spills and leaks (liquids and powders)	✓		
Dirty rags and sawdust		✓	
Area wash water		✓	
Clarifier sludges	✓		
Container disposal	✓		
Pipeline/tank drainage	✓		
Evaporative losses	✓		
Note: For a discussion of waste minimization options for reduction of shop clean-up wastes, see the EPA pollution prevention guide for the automotive repair industry.			
Body Repair			
Left over filler	✓		
Sanding dust		✓	
Painting			
Left over paint	✓		
Dirty wash thinner *Mineral spirits*	✓		
Empty containers	✓		
VOC air emissions		✓	
Particulate emissions		✓	
Dirty booth filters		✓	

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - VMF		Checked By
Date March 1992	Project Number	Sheet __ of __ Page __ of __

Worksheet 2a

WASTE MINIMIZATION: Material Handling

EPA

A. DRUMS, CONTAINERS, AND PACKAGES

Are drums, packages, and containers inspected for damage before being accepted? ☑ Yes ☐ No

Are employees trained in ways to safely handle the types of drums and packages received? ☑ Yes ☐ No

Are they properly trained in handling spilled raw materials? ☐ Yes ☑ No

Is there a formal personnel training program on raw material handling, spill prevention, proper storage techniques, and waste handling procedures? ☐ Yes ☑ No

Describe handling procedures for damaged items: *Return to vendor.*

How often is training given and by whom? *Train new employees first couple of weeks by shop foreman and senior maintenance employees.*

Is obsolete raw material returned to the supplier? *Batteries oil recycle* ☐ Yes ☐ No

Is inventory used in first-in first-out order? ☑ Yes ☐ No

Is the inventory system computerized? ☑ Yes ☐ No

Does the current inventory control system adequately prevent waste generation? ☑ Yes ☐ No

What information does the system track? *How much we purchase, what we use on each job (work order), and what we dispose of.*

Are stored items protected from damage, contamination, or exposure to rain, snow, sun, and heat? ☑ Yes ☐ No

Is the dispensing of raw materials supervised and controlled? ☑ Yes ☐ No

Are users required to return empty containers before being issued new supplies? ☑ Yes ☐ No

Do you maintain and enforce a clear policy of using raw materials only for their intended use? ☑ Yes ☐ No

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
Site Buffalo, NY - VMF		Checked By
Date March 1992	Project Number	Sheet __ of __ Page __ of __

Worksheet 2b

WASTE MINIMIZATION:
Material Handling

EPA

B. BULK LIQUIDS HANDLING

What safeguards are in place to prevent spills and avoid ground contamination during the filling of storage tanks?

High level shutdown/alarms	☐	Secondary containment	☑ *Paint room with dike*
Flow totalizers with cutoff	☐	Other	☑

Describe the system: *Manually filled by private vendor. Bulk oil, bulk antifreeze. Solvents are 55-gallon drums and 5-gallon pails.*

Are air emissions from solvent storage tanks controlled by means of:

Conservation vents	☐	Absorber/condenser	☐
Nitrogen blanketing	☐	Other vapor loss control system	☐

Describe the system: _____

Are all storage tanks routinely monitored for leaks? ☑ Yes ☐ No

If yes, describe the procedure and monitoring frequency for above-ground/vaulted tanks: *Visual inspection, walk around tanks.*

If yes, describe the procedure and monitoring frequency for underground tanks: *Gasoline, diesel fuel leak detection system.*

How are the liquids in these tanks dispensed to the users (i.e., in small containers or hard piped)? *Small containers, hand pumps; some are pumped through roll-up hose.*

What measures are employed to prevent the spillage of liquids being dispensed? *Train employees to be safe and alert when filling containers or vehicles.*

When a spill of liquid occurs in the facility, what cleanup methods are employed (e.g., wet or dry)? also discuss the way in which the resulting wastes are handled: *Dry - we use ground corn and Safety Kleen removes the filled drum of contaminated corn for $119.00 a drum.*

Firm USPS	Waste Minimization Assessment Worksheets	Prepared By
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Worksheet 3

OPTION GENERATION: Material Handling

EPA

Meeting format (e.g., brainstorming, nominal group technique) *Normal meeting group.*

Meeting Coordinator

Meeting Participants

Suggested Waste Minimization Options	Currently Done? Y/N	Rationale/Remarks on Option
A. Drums, Containers, and Packages		
Raw Material Inspection	*Y*	
Proper Storage/Handling	*Y*	
Return Obsolete Material to Supplier	*N/A*	*Look at vendor for removal*
Minimize Inventory	*Y*	
Computerize Inventory	*Y?*	
Formal Training	*Y*	
Waste Segregation	*Y*	
B. Bulk Liquids Handling		
High Level Shutdown/Alarm	*N*	
Flow Totalizers with Cutoff	*N*	
Secondary Containment	*Y*	*Paint room*
Air Emission Control	*N*	
Leak Monitoring	*Y*	*Underground*

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Worksheet 4a

WASTE MINIMIZATION:
Body Repair and Paint Application

EPA

A. BODY REPAIR

Do you generate large quantities of waste filler? ☐ Yes ☑ No

Are your workers supervised/trained so they do not mix more filler than required? ☑ Yes ☐ No

Do you currently employ rigid inventory controls to minimize product use? ☑ Yes ☐ No

Do you discourage the use of hoses to flush filler dust to the sewer or clarifier? ☑ Yes ☐ No

Are sweep brooms or vacuum units available for your workers to use? ☑ Yes ☐ No

Explain how you minimize waste from auto body repair: *We purchase bags of filler and the employees use the ringer to squeeze out just what they need. No cans to throw away.*

B. PAINT APPLICATION

Do you generate large quantities of waste paint or thinner? *20-gallon drums/month?* ☐ Yes ☑ No

Do you currently employ rigid inventory controls to minimize material use? ☐ Yes ☑ No

Do you use more than 1/2 gallon of thinner per car? ☑ Yes ☐ No

If yes, discuss how implementing more rigid controls could be accomplished in you shop: *Thinner used mostly in paint to spray.*

Is the volume of paint mixed based on the surface area to be painted? ☑ Yes ☐ No

Does the design of your mixing equipment prevent you from mixing smaller batches of paint? ☐ Yes ☑ No

Do you provide customers with leftover paint (enamel or lacquer only) for touch-up use? ☐ Yes ☑ No

Are operators trained to use their equipment properly so as to minimize overspray? ☑ Yes ☐ No

Are they periodically retrained? ☑ Yes ☐ No

What measures have you taken to reduce the generation of waste paint: *Mix what we need and recap.*

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Worksheet 4b

WASTE MINIMIZATION:
Body Repair and Paint Application

EPA

B. PAINT APPLICATION (Continued)

Who provides this training and how often is it given? *Shop foreman and local paint distributors; 1 or 2 years.*

Do your operators use large amounts of solvent to clean equipment? *Recycle by Safety Kleen* ☐ Yes ☑ No

Do they scrape out paint cups before rinsing? ☑ Yes ☐ No

Have you tried using or do you use an enclosed cleaning system? *Gun cleaning* ☑ Yes ☐ No

What was the effect? _____

Do you contract with an offsite thinner supplier/recycler? ☑ Yes ☐ No

Do you decant dirty thinner and use it as an initial wash thinner? *Safety Kleen recycles* ☐ Yes ☑ No

Do you paint more than 50 cars per month? *50 jobs partial and whole* ☐ Yes ☑ No

If yes, have you looked at onsite recycling systems? ☑ Yes ☐ No

Have you tried to list your waste with a certified waste exchange? ☑ Yes ☐ No

Please discuss any measures you have taken to recycle paint/thinner waste: _____

Have you investigated the use of low VOC paints? ☑ Yes ☐ No

Have you investigated the use of high transfer efficiency spray equipment? ☑ Yes ☐ No

If yes, did it reduce the amount of paint sprayed? *1/3 of paint* ☑ Yes ☐ No

Did it affect finish quality/customer satisfaction? ☑ Yes ☐ No

Have you investigated the use of styrofoam booth filters? ☐ Yes ☑ No

Discuss your success/failure with these options: *Investigate paint booth.*

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Worksheet 5

OPTION GENERATION:
Body Repair & Paint Application

EPA

Meeting format (e.g., brainstorming, nominal group technique)

Meeting Coordinator

Meeting Participants

Suggested Waste Minimization Options	Currently Done? Y/N	Rationale/Remarks on Option
A. Body Repair		
Mix filter according to need	Y	
Employ rigid inventory control	Y	
Sweep up or vacuum dust		*Vacuum sanding system*
B. Paint Application		
Employ rigid inventory controls	Y	
Mix paint according to need	Y	
Give customer touch-up paint	N	
Train operators to minimize overspray	Y	
Scrape out paint cups before rinsing	Y	
Use an enclosed cleaning system	Y	
Contract with a thinner supplier/recycler	Y	
Install onsite recycling equipment	N	
List waste with waste exchange	Y	
Use low VOC coatings	Y	
Use high transfer efficiency equipment	N	
Use cleanable styrofoam filters	N	

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Worksheet 6a

WASTE MINIMIZATION: Shop Clean-Up

EPA

In addition to automotive refinishing, do you perform automotive repairs? (If yes, please refer to the EPA pollution prevention guide for automotive repair shops.) ☑ Yes ☐ No

Are drip pans placed under leaking cars to reduce the need for floor cleaning? ☑ Yes ☐ No

Are dirty parts removed and placed on a drip pan instead of directly on the shop floor? ☑ Yes ☐ No

Are all work bays kept clean and neat? ☑ Yes ☐ No

Do your workers wipe up small spills of fluids as soon as they occur? ☑ Yes ☐ No

Do you have an award program for workers who keep their work bays clean (i.e., prevent leaks and spills)? ☐ Yes ☑ No

How are spilled fluids recovered and disposed of? *Dry system -- with ground corn spread over spill and absorbed. Safety Kleen picks up drum of contaminated corn for $119.00.*

Do you use a laundry service to clean your rags and uniforms? ☑ Yes ☐ No

If not, how are they handled? _____

Do you use a biodegradable detergent for cleaning shop floors? ☐ Yes ☐ No

Have you tried using a steam cleaner in place of chemical cleaners? ☑ Yes ☐ No
We use hot water (120°)

Do you discharge area washdown wastewater to a POTW or industrial sewer instead of to the storm drain? ☐ Yes ☑ No

If not, how is this wastewater handled? _____

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Worksheet 6b

WASTE SOURCES

EPA

Shop Clean-Up	Significance at Shop		
	Low	Medium	High
Obsolete raw materials		✓	
Spills and leaks (liquids and powders)	✓		
Dirty rags and sawdust		✓	
Area wash water		✓	
Clarifier sludges	✓		
Container disposal	✓		
Pipeline/tank drainage	✓		
Evaporative losses	✓		
Parts Cleaning			
Spent solvent cleaner *Recycled Safety Kleen*	✓		
Spent carburetor and brake cleaner *Recycled Safety Kleen*	✓		
Evaporative losses *Recycled Safety Kleen*	✓		
Leaks and spills (solvents)	✓		
Spent alkaline cleaner	✓		
Leaks and spills (alkali)			
Rinse water discharge	✓		
Sludges and filter wastes			
Maintenance and Repair			
Motor oil *Recycled*	✓		
Oil filters *Safety Kleen -- 60 filters per drum*	✓		
Gear and lube oil	✓		
Transmission fluid	✓		
Brake fluid	✓		
Radiator coolant *Safety Kleen*			
Brakes (asbestos)	*N/A*		
Radiators (lead) *Scrap iron by B.F.C.*	✓		
Batteries (lead and acid) *Fox Tire*	✓		
Junk parts *Scrap removed by B.F.C.*	✓		

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Worksheet 6c

WASTE MINIMIZATION: Material Handling

EPA

A. DRUMS, CONTAINERS, AND PACKAGES

Are drums, packages, and containers inspected for damage before being accepted? ☑ Yes ☐ No

Are employees trained in ways to safely handle the types of drums and packages received? ☑ Yes ☐ No

Are they properly trained in handling spilled raw materials? ☐ Yes ☑ No

Is there a formal personnel training program on raw material handling, spill prevention, proper storage techniques, and waste handling procedures? ☐ Yes ☑ No

Describe handling procedures for damaged items: *Return to vendor.*

How often is training given and by whom? *Train employees first couple of weeks by shop foreman and senior maintenance employees.*

Is obsolete raw material returned to the supplier? ☐ Yes ☐ No

Is inventory used in first-in first-out order? ☑ Yes ☐ No

Is the inventory system computerized? ☑ Yes ☐ No

Does the current inventory control system adequately prevent waste generation? ☑ Yes ☐ No

What information does the system track? *How much we purchase, what we use on each job (work order), and what we dispose of.*

Are stored items protected from damage, contamination, or exposure to rain, snow, sun, and heat? ☑ Yes ☐ No

Is the dispensing of raw materials supervised and controlled? ☑ Yes ☐ No

Are users required to return empty containers before being issued new supplies? ☑ Yes ☐ No

Do you maintain and enforce a clear policy of using raw materials only for their intended use? ☑ Yes ☐ No

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Worksheet 6d

WASTE MINIMIZATION: Material Handling

EPA

B. BULK LIQUIDS HANDLING

What safeguards are in place to prevent spills and avoid ground contamination during the filling of storage tanks?

High level shutdown/alarms	☐	Secondary containment	☑
Flow totalizers with cutoff	☐	Other	☐

Describe the system: *Manually filled by private vendor. Bulk oil, bulk antifreeze.*

Are air emissions from solvent storage tanks controlled by means of:

Conservation vents	☐	Absorber/condenser	☐
Nitrogen blanketing	☐	Other vapor loss control system	☐

Describe the system:

Are all storage tanks routinely monitored for leaks? ☑ Yes ☐ No

If yes, describe the procedure and monitoring frequency for above-ground/vaulted tanks: *Visual inspection, walk around tanks.*

If yes, describe the procedure and monitoring frequency for underground tanks: *Tank #01 - gasoline; tank #02 diesel fuel; leak detection system.*

How are the liquids in these tanks dispensed to the users (i.e., in small containers or hard piped)? *Small containers; hand pump; some are pumped through roll up hose.*

What measures are employed to prevent the spillage of liquids being dispensed? *Train employees to be safe and alert when filling containers or vehicles.*

When a spill of liquid occurs in the facility, what cleanup methods are employed (e.g., wet or dry)? also discuss the way in which the resulting wastes are handled: *Dry -- we use ground corn and Safety Kleen removes the filled drum of contaminated corn.*

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Worksheet 6e

WASTE MINIMIZATION: Parts Cleaning

EPA

A. SOLVENTS

Do you use parts cleaning solvent for uses other than cleaning parts?	☐ Yes ☑ No
Have you established guidelines as to when parts should be cleaned with solvents? *By vehicle maintenance analysis*	☐ Yes ☑ No
Do you use solvent sinks instead of pails or dunk buckets?	☑ Yes ☐ No
Are solvent sinks and/or buckets located near service bays?	☑ Yes ☐ No
Do you allow cleaned parts to drain inside the sink for a few minutes to minimize dripping of residual solvent onto the shop floor?	☑ Yes ☐ No
Are you careful when immersing and removing parts from the solvent bath so as not to create splashes?	☑ Yes ☐ No
Do you keep all solvent sinks/buckets covered when not in use?	☑ Yes ☐ No
Do you lease your solvent sinks?	☑ Yes ☐ No
If yes, does your lease include solvent supply and spent solvent waste handling?	☑ Yes ☐ No
If you own your solvent sinks, does a registered waste hauler collect your dirty solvent for recycling or treatment? *N/A*	☐ Yes ☐ No
Do you own onsite solvent recovery equipment such as a distillation unit?	☐ Yes ☑ No

If yes, how are the treatment residues handled? _____

_____

What other methods are you using to reduce solvent use/waste? _____

_____

B. AQUEOUS CLEANERS

Do you use dry pre-cleaning methods such as baking and/or *wire brushing* to reduce loading on the aqueous cleaner?	☑ Yes ☐ No
Have you switched from caustic-based cleaning solutions to detergent-based cleaners?	☑ Yes ☐ No
Do you use drip trays on hot tanks to minimize the amount of cleaner dripped on the floor? *N/A; No hot tanks*	☐ Yes ☐ No

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Worksheet 6f

WASTE MINIMIZATION: Parts Cleaning

EPA

B. AQUEOUS CLEANERS (Continued)

Are the hot tanks/jet spray washers located near the service bays? *N/A*	☐ Yes ☐ No
Do you pre-rinse dirty engine parts in a tank of dirty cleaning solution so as to reduce loading on the clean tank?	☑ Yes ☐ No
Do you routinely monitor solution composition and make adjustments accordingly?	☐ Yes ☑ No
Do you routinely remove sludge and solids from the tank? *Done by Safety Kleen*	☑ Yes ☐ No
Are sludge and solids screened out before they reach the waste sump? *Waste sludge managed by Safety Kleen*	☐ Yes ☐ No
Have you installed still rinses or converted free running rinses to still rinses? This water can be used as make-up to your cleaner bath.	☐ Yes ☑ No
Do you use demineralized water for your cleaning bath make-up?	☐ Yes ☑ No
Is your cleaning tank agitated?	☑ Yes ☐ No
Do you lease your hot tank(s)/jet spray washer(s)? *N/A*	☐ Yes ☐ No
If yes, do you use mechanical agitation instead of air agitation?	☐ Yes ☐ No
Do you own your hot tanks/jet spray washer(s)? *N/A*	☐ Yes ☐ No
Do you own onsite aqueous waste treatment equipment?	☐ Yes ☑ No
Does a hazardous waste hauler collect aqueous waste for recycling or treatment?	☐ Yes ☑ No

If not, how is your waste handled and disposed of? _____

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Worksheet 6g

WASTE MINIMIZATION: Waste Handling

EPA

A. AUTOMOTIVE FLUIDS

For facilities servicing fleet vehicles, do you test fluid quality to determine when automotive fluids should be changed? *Time bases* ☐ Yes ☑ No

When fluids must be drained to service a part, are they stored in a clean container so they may be used to refill the vehicle? ☑ Yes ☐ No

Have you had experience using any longer lasting synthetic motor oils? ☐ Yes ☑ No

If yes, please discuss: _____

Are all waste fluids kept segregated? ☑ Yes ☐ No

If not, have you notified your waste hauler or recycler? ☐ Yes ☐ No

Have you ever had a load of waste fluid rejected by a hauler or recycler because of cross contamination? ☐ Yes ☐ No

Please describe how you store and dispose of waste fluids (motor and lube oils, greases, transmission fluids, and spent anti-freezes): *Waste oil tank, waste antifreeze tank, transmission fluid goes in waste oil tank. 2 (500-gallon) new oil tanks above ground; 1 (450-gallon) waste oil tank underground; 225 ATF fluid above ground.*

B. OTHER WASTES

Are removed oil filters drained before disposal? ☑ Yes ☐ No

Do you dispose of filters in the trash? ☐ Yes ☑ No

If yes, have you contacted your waste oil hauler about alternative means of disposal? ☐ Yes ☐ No

If yes, what was the response? _____

Does a battery collector remove your used batteries? *Eldon batteries* ☑ Yes ☐ No

Do you take used batteries to a storage or recycling facility? ☑ Yes ☐ No
Eldon batteries

When replacing brakes, do you contain loose asbestos waste that may be released? ☑ Yes ☐ No
Nilfisk vacuum

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Worksheet 6h

WASTE MINIMIZATION: Waste Handling

EPA

B. OTHER WASTES (Continued)

Do you use a collection/recycling system to service air conditioning units? ☐ Yes ☐ No
Contracted -- Al Parker, Harium Rd.

Do you sell or give worn parts to a re-manufacturer? ☐ Yes ☑ No
Scrap iron; starter rebuilt -- B&K; component rebuilt here at VMF.

Do you have any suggestions for reducing other wastes? *Radiators rebuilt by Moxie.*

C. SHOP CLEAN-UP

Are drip pans placed under leaking cars to reduce the need for floor cleaning? ☑ Yes ☐ No

Are dirty parts removed and placed on a drip pan instead of directly on the shop floor? ☑ Yes ☐ No

Are all work bays kept clean and neat? ☑ Yes ☐ No

Do your workers wipe up small spills of fluids as soon as they occur? ☑ Yes ☐ No

Do you have an award program for workers who keep their work bays clean (i.e., prevent leaks and spills)? ☐ Yes ☑ No

Do you use a laundry service to clean your rags and uniforms? ☑ Yes ☐ No

Do you use a biodegradable detergent for cleaning shop floors? ☑ Yes ☐ No

Have you tried using a steam cleaner in place of chemical cleaners? ☑ Yes ☐ No
We use hot water (120°)

Do you discharge area washdown wastewater to a POTW or industrial sewer instead of to the storm drain? ☐ Yes ☑ No

If not, how is this waste handled? _____

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Worksheet 7a

OPTION GENERATION: Shop Clean-Up

EPA

Meeting format (e.g., brainstorming, nominal group technique)_____

Meeting Coordinator_____

Meeting Participants_____

Suggested Waste Minimization Options	Currently Done? Y/N	Rationale/Remarks on Option
Use Drip Pans	Y	
Wipe Up Spills (Cotton Rags)	Y	
Keep Bay Clean	Y	
Award Program	N	
Use Laundry Service	Y	
Use Biodegradable Detergents		
Use Steam Cleaners		
Discharge to POTW/Industrial Sewer		

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Worksheet 7b

INPUT MATERIALS SUMMARY

EPA

Attribute	Description[1]			
	Solvent Cleaner	Brake Cleaner	Alkaline Cleaner	Motor Oil
Name/ID	*Mineral Spirits*	*Safety Kleen*	*Johnson detergents*	*Bulk Noco quart can recycled for shipping to A.O.*
Source/Supplier	*JP Industrial Safety Kleen*	*Castle Products JP Industrial*	*Johnson*	*92% Safety Kleen*
Component/Attribute of Concern				
Annual Consumption Rate	*2.1 tons*	*60 gal. year*	*1,500 gal. year*	*12,558 quarts/ year Manifest Mineral Spirits*
• Overall				
• Component(s) of Concern				
• Purchase Price, $ per __				
• Overall Annual Cost				
Delivery Mode[2]	*Safety Kleen with drums*	*Safety Kleen*	*Tanker truck*	*Bulk tank & quart*
Shipping Container Size & Type[3]	*55 gal. drums*	*55 gal. & 30 gal.*	*500 gal. tank bulk*	*8,500 tanker*
Storage Mode[4]	*In furnished*	*By Safety Kleen only what used*	*1 bulk tank, 165 gal.*	*500 gal. tank & quarts*
Transfer Mode[5]	*Safety Kleen pump in*	*Pump*	*Hand pump*	*Pump*
Empty Container Disposal/Management[6]	*N/A*	*N/A*	*N/A*	*Quarts trash*
Shelf Life	*N/A*	*N/A*	*N/A*	*N/A*
Supplier Would				
• Accept expired material (Y/N)	*Y*	*Y*	*Y*	*Y*
• Accept shipping containers (Y/N)	*They furnish*	*They furnish*	*N/A*	*N/A*
• Revise expiration date (Y/N)	*N*	*N*	*N*	*N*
Acceptable Substitute(s), if any	*N*	*N*	*Mild detergent*	*N*
Alternative Supplier(s)	*N/A*	*N/A*	*Y*	*Y*

[1]Stream numbers, if applicable, should correspond to those used on process flow diagram.
[2]e.g., pipeline, tank care, 100 bbl. tank truck, truck, etc.
[3]e.g., 55 gal. drum, 100 lb. paper bag, tank, etc.
[4]e.g., outdoor, warehouse, underground, aboveground, etc.
[5]e.g., pump, forklift, pneumatic transport, conveyor, etc.
[6]e.g., crush and landfill, clean and recycle, return to supplier, etc.

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Worksheet 7c

INPUT MATERIALS SUMMARY

EPA

Attribute	Description[1]				
	Oil Filters	Gear & Lube Oil	Transmission Fluid	Brake Fluid	Radiator Coolant
Name/ID	*Fram A/C Hastings*	*80/90*	*ATF*	*DOT 5*	*Antifreeze*
Source/Supplier	*Wholesale Wheeler Bros. Auto*	*Southwest Supply*	*Niagara Lube*	*Milfred Product Co.*	*Niagara Lube wholesale*
Component/Attribute of Concern					
Annual Consumption Rate	*Filters-1,800*	*14 ea., 55 gal.*	*1,200-1,400 gal. year*	*80 gal. year*	*250 gal./yr.*
• Overall					
• Component(s) of Concern					
• Purchase Price, $ per __					
• Overall Annual Cost	*Approx. $3,600*	*$1,540*	*$3,000*	*$2,100*	*$1,500*
Delivery Mode[2]	*Truck*	*Drum truck*	*Tanker truck*	*Truck*	*Truck*
Shipping Container Size & Type[3]	*N/A*	*55 gal.*	*N/A*	*gal.*	*Bulk & gal.*
Storage Mode[4]	*New-parts room Old-drum*	*In oil room*	*250 gal. tank/oil room*	*Stock room*	*Bulk tank stock room*
Transfer Mode[5]	*New-Old-drum*	*Pump*	*Pump*	*By hand*	*Pump*
Empty Container Disposal/Management[6]	*Safety Kleen*	*Feldman drum & barrel*	*N/A*	*Plastic trash jugs*	*Plastic trash*
Shelf Life	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Supplier Would					
• Accept expired material (Y/N)	*Y*	*Y*	*Y*	*Y*	*Y*
• Accept shipping containers (Y/N)	*Furnished*	*N*	*N/A*	*N*	*N*
• Revise expiration date (Y/N)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Acceptable Substitute(s), if any	*N*	*N*	*N*	*N*	*N*
Alternative Supplier(s)	*N*	*N*	*N*	*N*	*N*

[1]Stream numbers, if applicable, should correspond to those used on process flow diagram.
[2]e.g., pipeline, tank care, 100 bbl. tank truck, truck, etc.
[3]e.g., 55 gal. drum, 100 lb. paper bag, tank, etc.
[4]e.g., outdoor, warehouse, underground, aboveground, etc.
[5]e.g., pump, forklift, pneumatic transport, conveyor, etc.
[6]e.g., crush and landfill, clean and recycle, return to supplier, etc.

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Worksheet 7d

INPUT MATERIALS SUMMARY

EPA

Attribute	Description[1]				
	Brakes (asbestos)	Radiators (lead)	Batteries (lead & acid)	Rinse Water	Rags & Absorbent
Name/ID	*Bee Cee Nu Turp grizzly*	*Repair Recycle*	*Delco Deka*		*Morgan Oil PAAS Country Corn*
Source/Supplier	*Wheeler Bros. Clutch Wholesale Auto*	*Moxies*	*Eldon*		*3 m. Morgn Safety Klfe*
Component/Attribute of Concern					
Annual Consumption Rate	*1200-1500 sets per year*	*300 ea.*	*280 ea.*		*1500 rags 80 bundle year*
• Overall					
• Component(s) of Concern					
• Purchase Price, $ per __					
• Overall Annual Cost	*$1,200-1,500*	*$5,400*	*$14,000*		*?*
Delivery Mode[2]	*Truck*	*Truck*	*Truck*		*Truck*
Shipping Container Size & Type[3]	*Boxes*	*Boxes*	*Boxes*		*Drum-corn boxes-pads*
Storage Mode[4]	*stock room*	*stock room*	*stock room*		*stock room*
Transfer Mode[5]	*hand*	*hand*	*hand*		*hand*
Empty Container Disposal/Management[6]	*Buff Clutch Wholesale Auto Wheeler Bros*	*Trash*	*Eldon: takes Old Batteries*		*Corn-Safety Kleen pad-trash rag-recycle-laundry*
Shelf Life	*N/A*	*N/A*	*N/A*		*N/A*
Supplier Would					
• Accept expired material (Y/N)	*N/A*	*Scrap Iron*	*Y*		*N/A*
• Accept shipping containers (Y/N)	*N/A*	*N/A*	*N/A*		*N/A*
• Revise expiration date (Y/N)	*N/A*	*N/A*	*N/A*		*N/A*
Acceptable Substitute(s), if any	*N/A*	*N/A*	*N/A*		*N/A*
Alternative Supplier(s)	*N/A*	*N/A*	*N*		*N/A*

[1]Stream numbers, if applicable, should correspond to those used on process flow diagram.
[2]e.g., pipeline, tank care, 100 bbl. tank truck, truck, etc.
[3]e.g., 55 gal. drum, 100 lb. paper bag, tank, etc.
[4]e.g., outdoor, warehouse, underground, aboveground, etc.
[5]e.g., pump, forklift, pneumatic transport, conveyor, etc.
[6]e.g., crush and landfill, clean and recycle, return to supplier, etc.

APPENDIX B

ESTIMATED LIQUID AND SOLID WASTES

Estimated Liquid and Solid Wastes Generated from Vehicle Maintenance Operations U.S. Postal Service Buffalo, NY

Waste Type	Annual Quantity	Management Method	Annual Disposal Cost	Source of Data	Assumptions
Oil Filters	1,374 lbs per year or approx. 1800 filters per year	The filters are collected (uncrushed) in a 30 gal. drum (approx. 60 per drum) and recycled by Safety Kleen. The metal from the casings is recovered and the filters are burned as fuel.	$2564.90	Waste manifests Worksheet 7b - Input Materials Summary.	Average oil filter production weights and disposal costs are based on costs and production experienced between the beginning of Jan. to the end of March (1992).
Batteries	280 per year	Used lead acid batteries are returned to a local supplier (Eldon Batteries) who ships them to a smelting plant which reclaims the lead.	No charge	Worksheet 7c - Input Materials Summary	A one to one relationship is assumed relative to the number of batteries bought to the number of used batteries produced.
Antifreeze	300 gal. per year	Used antifreeze is stored and recycled by Safety Kleen. Satellite branches, which receive a significant amount of antifreeze from the VMF (in one-gallon containers) manage their waste separately.	No charge	USPS	The number for annual waste production is based on the most recent manifested volume. Pickup occurs yearly.
Brakes	1200-1500 sets per year	The brake pads for the larger vehicles (trailers) are relined and the steel shell recovered for scrap. The brake pads from smaller vehicles are only recovered for metal value.	info requested	USPS	
Motor Oil Brake Fluid Transmission Fluid	2830 gal. per year	Combined and recovered via distillation through Safety Kleen's Recycle Engine Oil Program. The recovered oil is then returned to USPS for reuse.	No charge	Notes used to determine annual waste production for the 1987 Hazardous Waste Audit Report	The annual production is based on 1987 data.
Solvent Engine Parts Cleaner	5,746 lbs per year	Collected by Safety Kleen.	$3,744 per year	Waste manifests and Safety Kleen purchase invoices.	Average production volumes and disposal costs are based on costs and production experienced between the beginning of Jan. to the end of March (1992).

Waste Type	Annual Quantity	Management Method	Annual Disposal Cost	Source of Data	Assumptions
Solvent Brake Parts Cleaner	2,106 lbs per year	Collected by Safety Kleen.	$2,262	Waste manifests and Safety Kleen purchase invoices	Average production volumes and disposal costs are based on costs and production experienced between the beginning of Jan. to the end of March (1992).
Wastes Produced During Vehicle Washing, Large Parts Washing, and Floor Washing Using Alkaline Cleaners - Washwater	Undetermined	The alkaline cleaner are used in the "floor scrubber" and "pressure washer" to wash down floors and cars. The washwater produced passes through an oil and water separator before proceeding to the municipal wastewater treatment facility.	Part of sewer fee	USPS	Virtually all the alkaline cleaner purchased by the Postal Service is used.
- Oil/Grease Sludge from oil/water separator	2,255 gal removed in 1989	The oil/grease sludge was last collected by Safety Kleen for incineration in 1989.	Undetermined	USPS	None
Cracked Corn Absorbent	1 - 2 30 gal. drums per year	Safety Kleen collects and fuel blends for incineration as a fuel.	$590 per year	USPS	Since the first drum of cracked corn waste was only half full, average annual production was calculated by determining the period over which this material had accumulated (from March to June) and extrapolating assuming a constant the rate of waste production.
Oil Absorbent Pads	36 bundles	Municipal waste compactor	Not quantified. Part of overall compactor fee.	USPS	
Soiled Rags	8,515 rags per year	Morgan Linen Service for laundering.	$596 per year	USPS	Average production volumes and disposal costs are based on rag usage over a 4 week period in May/June of 1992.

Waste Type	Annual Quantity	Management Method	Annual Disposal Cost	Source of Data	Assumptions
Paint Equipment Cleaner (Spray Gun)	1118 lbs (202 gal.) per year	These fluids are collected and recycled by Safety Kleen.	$2496 per year	Waste manifests and Safety Kleen's invoices.	Average production volumes and disposal costs are based on costs and production experienced between the beginning of Jan. to the end of March (1992).
Paint Thinner Waste (excess paint, sludges collected from the spray gun still)	1664 lbs (277.3 gal) per year	The waste paints and still sludges are collected and incinerated by Safety Kleen.	$591.5 per year	Waste manifests and Safety Kleen's invoices.	Average production volumes and disposal costs are based on costs and production experienced between the beginning of Jan. to the end of March (1992).
Paint Cans - non-aerosol	2,402 qt cans per year	Disposed of in municipal waste dumpster.	No extra charge	USPS	A one to one relationship is assumed relative to the number of cans of paint bought to the number of cans of paint disposed of.
Paint Cans - aerosol	Approx. 840	Recycled as metal scrap.	No charge	USPS	
Paint Filters	2912 filters per year	Thrown in municipal trash dumpster. Wet down if left in dumpster over 24 hours.	No extra charge	Contractor note from onsite visit.	2096.64 Interview with USPS personnel
Radiators	280 radiators per year	Recycled for scrap iron content by BFC or re-built by Moxie.	$7000	Worksheet 7c - Input Materials Summary	A one to one relationship is assumed relative to the number of radiators bought to the number of cans of radiators disposed of.
Used Tires	1138-1200 small tires 232 large tires	Small tire casings are managed through Fox Tire. Reusable tires are re-capped and non-reusable tires are disposed of. The Buffalo VMF does not use re-capped small tires. Larger traction tires are re-capped for reused by the Post Office, while larger steering tires are sold to the tire recycler and re-capped for private sale.	$1800	USPS	This cost is expected to decrease.

APPENDIX C

Alternative Coatings Article

Coatings for Compliance

Congress is scheduled to debate the Clean Air Act this year, and VOC emission limits for liquid industrial coatings are expected to be lowered. What's a finisher to do? Comply . . .

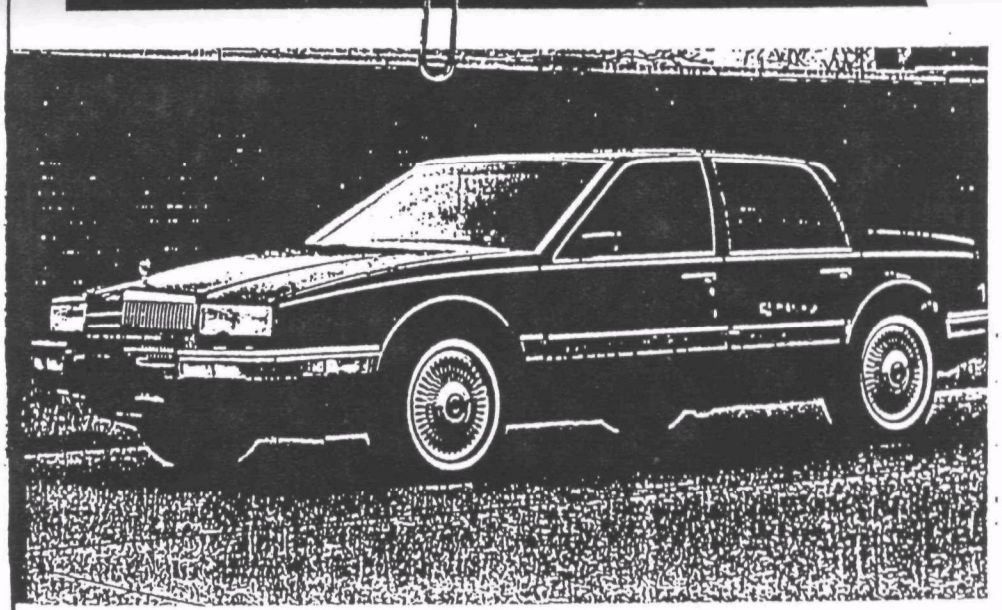
By Beverly A. Graves
Associate Editor

At one time low-solids/high-solvent coatings prevailed in the finishing industry. There was no need to worry about things such as volatile organic compound (VOC) emissions or air toxics. Easily applied finishes, with quick cure for swift turnaround were the order of the day. But the situation did not remain sunny and carefree. In fact, it became fairly cloudy. And that's when the government decided to clean the air.

Believe it or not, the original Clean Air Act was passed in 1955, according to Anthony J. Buonicore, vice president of Environmental Science & Engineering, Inc., Shelton, Conn., in his presentation at Surface Coating '90 in Sturbridge, Massachusetts. Most people do not remember this first legislation but do remember Rule 66 in California as the first major air-pollution-control regulation.

Rule 66 restricted the amount of photochemically reactive solvents plants could discharge. Testing on photochemical solvent reactions performed in smog chambers showed that organic solvents in the air react photochemically, leading to ozone formation and smog. Rule 66 was born as a result of these tests.

The original Clean Air Act of 1955 was amended in 1960, '63 and '65, before the Air Quality Act of 1967 replaced it. (Although the name changed, the original name stuck.) In 1970 the Clean Air Act Amendments were passed, establishing ambient air limits for various



GENERAL MOTORS' Buick, Oldsmobile, Cadillac Hamtramck plant uses low-VOC, two-component polyurethane clear coats on its luxury vehicles.

pollutants. EPA was also established. The act placed the responsibility for air pollution control with the states. Each state needed to submit plans for implementing regulations that would meet the National Ambient Air Quality Standards.

Amendments followed in 1977, and Congress was to review the Clean Air Act in 1981, but did not. Congress is presently debating amendments to the Clean Air Act. Three bills have been introduced.

One bill deals with air toxics: air pollutants that pose a potential health risk. Each year in the U.S. 2.7 billion lbs of toxic chemicals are emitted. The bill proposes reducing this number by 75 pct. Many of the nearly 190 hazardous chemicals listed in this bill are covered under SARA Title III. Mr. Buonicore in his address stated, "To comply, the coatings industry will have to make substantial investments in process changes, product substitutions, systems enclosures or emission capture and control systems."

So, what types of low-VOC coatings are available? They include water-borne electrocoatings and non-electrocoatings; high-solids, both single- and two-component; chlorinated-solvent-thinned coatings; powder coatings; radiation curable coatings; and a relatively new technique that replaces solvent with CO_2.

Powder coatings are proving to be a viable option for many finishers seeking compliance with VOC regulations. The technology has been enjoying double-digit annual growth for a number of years. This growth is forecast to continue for some time into the future. However, the scope of this article is to look at liquid coatings options for finishers who, for various reasons, will prefer to stay with liquid finishing lines. For that reason, powder coatings will not be discussed in this report.

Water-borne coatings generally satisfy low-VOC regulation requirements. After water evaporates, water-borne coatings have characteristics, both chemical and physical, similar to solvent-borne coatings. Water-bornes can be applied by electrocoating or spray, dip and flow coating.

High-solids coatings offer economic as well as environmental advantages. High-solids, both single- and two-component, usually meet low-VOC standards. Because solids are substituted for solvent, more surface can be coated per gal, but they also have their disadvantages, individual to each coating type.

Another potential method for reducing VOCs is with chlorinated-solvent-thinned coatings. According to James A. Mertens of Dow Chemical Company, 1,1,1-trichloroethane does not cause increased ozone in the lower atmosphere as do photochemically reactive solvents. 1,1,1-trichlorocthane can be used in most resin systems, including polyesters, acrylics, alkyds, epoxies, phenolics, nitrocellulosics and others.

But all is not well and good with chlorinated-solvent-thinned coatings. A bill has been proposed in Congress that would list 1,1,1 and methylene chloride, among others, as hazardous chemicals, and their release would be strictly controlled.

Radiation-curable coatings use ultraviolet or electron-beam energy to cure 100-pct reactive liquid coatings. Coating choices are limited. Substrates are usually limited to cylindrical and flat substrates, but coatings have been cured on objects having moderate complexity.

Radiation curable coatings eliminate the risk of solvent explosion and pollution hazards, because they emit no VOCs. They will also cure on heat-sensitive substrates. One disadvantage, according to Carl Izzo of Westinghouse, Pittsburgh, Pennsylvania, is that the larger the part, the more energy is needed to cure the paint, and consequently profit is not as great.

CO_2 for Solvent. Recently a new system for reducing VOCs 30 to 70 pct was unveiled by Union Carbide. In the process paint concentrate is mixed with a precise amount of supercritical carbon dioxide. The mixture is drawn through tubing and atomized as it is released from a spray gun. The CO_2 spreads out from the spray gun into the atmosphere. Wet paint film remains on the substrate with enough solvent to give it the appearance the applicator wants.

Specially designed spray equipment is required, but is easily retrofitted to existing paint and finishing lines. It is adaptable to both manual and automated operations and works in both electrostatic and non-electrostatic spray lines. Union Carbide has licensed the technology to several paint manufacturers.

Transfer Efficiency. Does transfer efficiency affect VOC emissions? According to Ron Joseph, president of Ron Joseph & Associates, Inc., Saratoga, California, transfer efficiency is probably one of the most important parameters in reducing VOC emissions. The greatest benefits are derived when transfer efficiency is low (five to 20 pct).

As transfer efficiency increases, additional increments have a lesser effect on VOC emissions, and the law of diminishing returns applies. A shift in transfer efficiency from 80 to 90 pct will yield a very small benefit in terms of air quality, whereas a shift from five to 10 pct will halve VOC emissions.

Although Mr. Joseph does not have conclusive data, he believes that lower solids coatings will yield lower transfer efficiencies than high-solids coating, when tested under the same conditions. Therefore, water-borne coatings, which often have a volume solids of 20 to 40 pct, may provide lower transfer efficiency than high-solids, solvent-borne coatings.

Water-Borne Electrocoating

Dr. George E. F. Brewer is principally credited with originating the electrocoating process in the late 1950's. But Dr. Brewer states that it was not a viable process until 1961. Originally developed for the automotive industry, electrocoating soon found its way into the appliance, metal furniture and other industries.

There are two types of electrocoating processes, anodic and cathodic. In both methods parts are immersed in an electrically charged coating. Anodic coatings deposit on a positively charged part, the anode, and cathodic coatings deposit on the negatively charged part, the cathode.

Cathodic coatings usually require better surface preparation than anodic coatings, but provide better corrosion resistance. Anodic coatings have lower bake temperatures, some as low as 250F. An air-dry version has been developed recently. Also, the resin for anodic coatings generally costs less. Electrocoat resin types include polyester, epoxy esters and acrylics.

Recent improvements in cathodic electrocoatings include higher film build, improved edge coverage and throwing power, reduced pinholing over zinc galvanized alloy, reduced VOCs and lower curing temperatures. Industry is demanding more improvements, including better corrosion resistance, shorter baking times and even lower temperatures and VOCs.

Anodic electrocoatings have their own advantages. Coating thicknesses as low as 0.4 mil will hide and protect the substrate. They have lower bake temperatures than cathodic, as mentioned previously.

The overall basic strength of water-borne electrocoatings, according to several paint suppliers, is their high application efficiency. Other strengths include even coverage, VOC compliance, good appearance and application efficiency.

Weaknesses include equipment costs, tank maintenance and color variety. Other disadvantages include the need for corrosion-resistant pumps, pipes and tanks and sensitivity to surface cleanliness.

VOC levels are becoming the most important consideration for finishers. VOC levels for water-borne electrocoatings range from less than 2 to 3.5 lb/gal. In addition to the automotive industry, industries using electrocoatings include metal and wood doors, compressors, tools, blower housings and fans, electrical switch gear, office equipment, computers, and appliances.

The future for water-borne electrocoatings, as envisioned by paint suppliers, varies. Some see an increase in use while others feel the market is saturated. All believe that electrocoating is here to stay.

Water-Borne Non-Electrocoating

Water-borne coatings (non-electrocoat) can be air-dried, force-

TABLE I—Comparison of Coating Technologies

Coating Technology	Single-Component	Two-Component	Drying Time[1]	Film Thickness Control	Hardness	Abrasion Resistant	Resistance to: Chemicals	Resistance to: Solvents	Resistance to: Sunlight	Special Application Equipment	Facility Equipment Cost	Coating Cost
Alkyds & Acrylics High-Solids (Air-Dry)	Yes	No	Slow	Fair	Fair	Fair	Fair	Poor	Fair	No	Low	Low
Alkyds, Acrylics & Polyesters High—Solids (Baking)	Yes	No	Medium to Fast (Bake)	Fair	Good	Good	Very Good	Very Good	Very Good	No[3]	Medium	Medium
Epoxies—High-Solids	No	Yes	Medium	Fair	Very Good	Very Good	Very Good	Good	Poor	No	Low	Medium to High
Polyurethanes High-Solids	No	Yes	Medium	Fair to Good	Very Good	Very Good	Very Good	Very Good	Very Good	No[4]	Low[4]	Medium to High
Water-Borne Alkyds & Acrylics (Air-Dry)	Yes	No	Medium to Fast	Good	Fair	Fair	Poor	Poor	Fair	No	Low	Medium
Water-Borne Alkyds & Acrylics (Baking)	Yes	No	Medium to Fast (Bake)	Good	Good	Good	Good-Very Good	Good-Very Good	Good	No	Medium	Medium
Powder	Yes	No	Medium to Fast (Bake)	Fair to Good	Very Good	Very Good	Very Good	Very Good	Fair-Good	Yes	Medium to High	Medium
Electrodeposition	Yes	No	Medium to Fast (Bake)	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Yes	High	Medium

(1) Drying Times: slow drying = 3-8 hours; medium = 1-3 hours; medium-fast = 20-60 min.
(2) No data available, but expected to be good.
(3) Some situations require high-speed, turbine-powered bells or discs.
(4) Some high-solids polyurethanes must be spray-applied through plural-component spray equipment.

(Source: Ron Joseph, Ron Joseph & Assoc.)

dried or baked. Forced drying allows coatings to develop their final properties more quickly. Baking systems provide for denser paint films and improved performance.

Non-electrocoat water-borne resin types include acrylic latex, halogenated copolymer latex, aqueous urethane, alkyds, modified alkyd, alkyd and acrylic melamines, acrylics, phenolics, acrylic latexes, vinyl emulsions, epoxies and epoxy esters and polyesters.

Various suppliers point out that acrylic water-bornes air dry quickly, can be dip or spray applied, show good adhesion and gloss. And, according to Thomas N. Dietsch Jr. of The Thermoclad Co., Erie, Pennsylvania, acrylics perform better outdoors than alkyds. Alkyds have excellent application properties, however.

Ken Lawrence of Progress Paint in Louisville, Kentucky, touted the performance properties of epoxy esters, saying that they provide excellent adhesion on less-than-clean surfaces. Chuck Cosner of Maurer-Schumaker in Livonia, Michigan, agrees that both epoxies and epoxy esters provide good adhesion. He also adds that they offer good corrosion and chemical resistance, hardness and flexibility.

Phenolics are corrosion and chemical resistant and have better performance in outdoor applications than alkyds. Vinyls also provide good corrosion resistance, as well as good adhesion.

The VOC levels reported for water-borne non-electrocoatings range from less than one half to 3.5 lb/gal.

Applications for water-borne non-electrocoatings are varied. Industries using these coatings include aerospace; transportation; automotive; appliance; steel containers; rail-car accessories; air conditioning parts and housings; structural steel; metal furniture; metal and wood doors; shelving and storage racks; truck engines; farm equipment; light fixtures; and many more.

These coatings strengths include low VOCs, smooth film, corrosion resistance, good adhesion, easy application and clean up, low-cost equipment outlay, non-flammable, fast drying and low toxicity.

Bud Pare of Strathmore Products in Syracuse, New York, contends that in many cases water-borne products equal solvent-borne products in performance, particularly in areas such as gloss, color, corrosion resistance and a[illegible]sion. In fact, one such product has been developed that in tests surpasses solvent-bornes in corrosion resistance.

Close control of paint application parameters is necessary when applying water-borne coatings. Drying time is affected by humidity and temperature, because water evaporates more slowly than solvent. Water-borne paints also tend to blister when placed in baking ovens without sufficient flash-off time.

Suppliers state that the increasing

limitations on VOC emissions will increase the attractiveness and use of water-bornes. Some suppliers see the need to boost user confidence in water-borne finishes. As Tracy Garrett Jr. of Deft Inc., Irvine, California, sees it, "A lot of users remember the old consumer latex (water-borne) paints that came out when oil-based paints were outlawed. Those old paints didn't stick, and they generally were not good. Unfortunately this carried over into industrial situations."

Catalyzed resin systems overcome some of the problems associated with water-bornes. The systems are said to "trick" the chemicals in the paint into accepting water only as the carrying agent. Because the water in the paint acts only as a carrier, the paint film is not subject to moisture and humidity to the extent that other water-borne paints may be. These coating systems are used for construction equipment, fighter aircraft and tanks.

Suppliers see a continuing effort to lower VOC content and enhance performance properties of water-borne coatings.

Two-Component High-Solids

High-solids is now a fast-growing coatings technology. But, according to Sudhir Laddha and Raymond T. Chlodney of Essex Products, Clifton, New Jersey, the early high-solids coatings had their problems. These included heavy-film build, high bake temperatures, greater clean-up time, high-cost, high viscosity, inferior gloss, limited moisture resistance and solvent popping.

Systems developed later had lower drying times and viscosities, and they could be applied with conventional equipment. Most recent developments in high-solids coatings have further improved on these characteristics.

Two-component coatings are generally used when good hardness; abrasion, corrosion, chemical and solvent resistance; and exterior durability are required. They are also used when bake ovens cannot be used because of heat-sensitive substrates. High-solids, two-component resins include acrylics, epoxies, polyesters and acrylic urethanes, polyurethanes and polyester-based polyurethanes.

Acrylic urethanes, according to paint suppliers, offer excellent gloss and color retention as well as excellent chemical resistance.

Ken Peter of Perry & Derrick, Cincinnati, Ohio, extols the attributes of epoxies saying they offer excellent adhesion and toughness as well as chemical, solvent and water resistance.

Polyester urethanes offer excellent gloss and color retention and good chemical resistance. Polyurethanes also offer high gloss, flexibility, chemical and solvent resistance, in addition to durability, weatherability, abrasion resistance and easy cleaning. Vic Scaricamazza of Morton International Specialty Chemi-

cals Group, Chicago, Illinois, adds that two-component urethanes also offer excellent corrosion resistance.

VOCs for two-component, high-solids coatings range from 2.7 to 3.5 lb/gal. The transportation manufacturing industry appears to be the largest user. Cars, car carriers, buses, heavy-duty tractors, trucks, truck trailers, rail cars, marine commercial aircraft and high-precision fighter aircraft manufacturers use two-component, high-solids coatings. Other industries also using the coatings include manufacturers of ground-support equipment for fighter aircraft, aircraft components, composite containers, machine tools and other miscellaneous items. Two-component, urethanes also are used extensively on products made of plastics and other heat-sensitive materials.

But these coatings do have their limitations. The major shortcoming, according to most suppliers, is short pot life (as little as four hours to as much as 12 to 24 hours). Another drawback is that in some instances the coatings are more difficult to apply uniformly and have slower drying times. As Carl Varga of Man-Gill Chemical Co., Cleveland, Ohio, says, a particular weakness of polyurethanes is concern over health hazards of isocyanates. But he adds that suppliers are working to remove isocyanates while maintaining a quality coating.

Two-component, high-solids coatings are also either air dried, force dried or baked. According to EPA regulation, air-dried or force-dried coatings are defined as those dried below 194F. Baked coatings are cured above 194F. They include polyesters, acrylics, epoxies and alkyds.

Air-dry coatings by nature consume less energy when curing. They are ideal for large machines and heat-sensitive substrates.

Use of two-component, high-solids coatings should increase, according to finish suppliers. Especially for finishers who need to comply with regulation while providing high-performance finishes.

One company needing to do just that was The Ford Motor Company. In 1988, Ford specified that two-component polyurethane clear coat be used on its models. The coating is said to provide a higher gloss, smoother and more durable surface than conventional paints. The topcoat also resists environmental "fall out" such as acid rain.

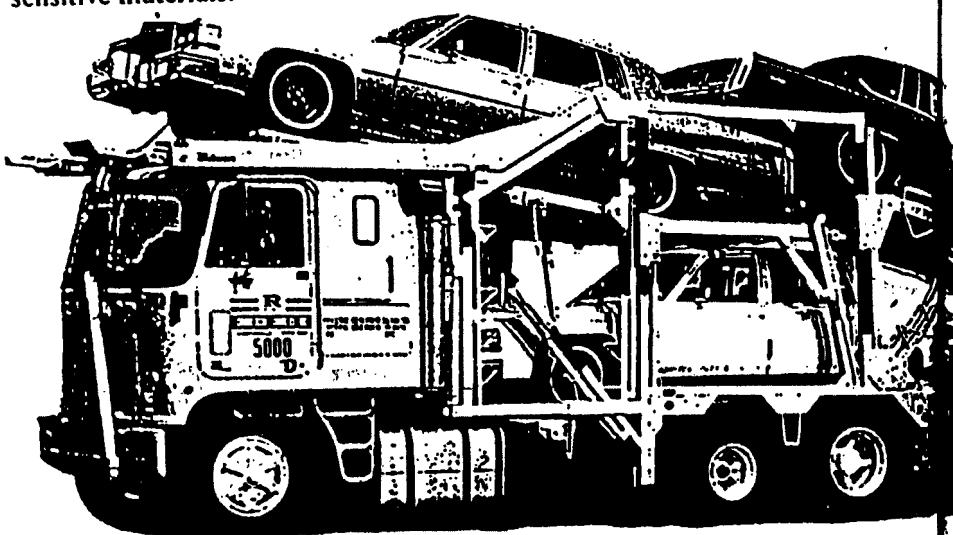
According to Dale Bayer of Mobay, suppliers of raw materials for polyurethane coatings, more than 90 pct of the automotive plastic market in Europe uses two-component urethanes. The coatings have a 40 pct market share in Japan. In the U.S. the market share is only 10 pct, but growing.

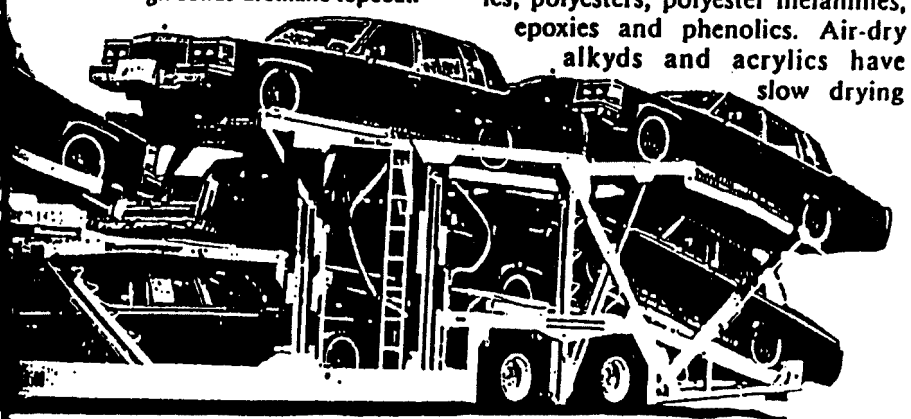
General Motors also uses two-component polyurethane clear coats. They are applied to its luxury vehicles manufactured at G. M.'s Hamtramck plant in Detroit, as well as its other assembly facilities.

Sherwin-Williams is also finding a market for its low-VOC two-component polyurethane enamels. Markets include computer housings, burial caskets, measuring and dental equipment, sewing machines and snowmobiles.

Single-Component High-Solids

Resins for single-component, high-solids coatings include alkyds, alkyd melamines, alkyd ureas, acrylics, polyesters, polyester melamines, epoxies and phenolics. Air-dry alkyds and acrylics have slow drying





CAR CARRIER is first coated with a low-VOC high-solids primer followed by a low-VOC high-solids urethane topcoat.

times (three to eight hrs), with average hardness, abrasion chemical and sunlight resistance. Baked alkyds, acrylics and polyesters dry in 20 to 60 min, with some coatings air drying in as little as 15 to 18 min.

As mentioned, air-dry or force-dry coatings consume less energy than baked coatings. Force-dry systems, where some heat is used to accelerate drying, cure at 120 to 160F. Although these systems show good corrosion resistance and physical attributes, they do require more time to attain adequate hardness.

Baking-type high-solids coatings require high bake temperatures, sometimes up to 350F. But coatings being developed will permit reduced bake temperatures. Baked single-component, high-solids coatings have hard films and chemical and physical properties comparable to two-component coatings, according to Mr. Joseph.

Because of the high bake temperatures, single-component coatings cannot be applied to plastics and other heat-sensitive substrates. Also, if not cured above a minimum temperature, they remain tacky indefinitely, Mr. Joseph warns.

VOC levels for single-component, high-solids coatings range from 2.3 to 3.5 lb/gal.

According to Chuck Cosner of Maurer-Schumaker, single-component coatings are best for industries where ultimate corrosion protection and durability are required. Users of these coatings include steel door, new and reconditioned drums, metal furniture, tool boxes, aluminum extrusion, window, appliance, bicycles, tricycles, exercise equipment, waste receptacles, light fixtures, battery chargers, auto parts and shelving manufacturers.

Coating advantages, as compared to two-component, include longer pot life and no mixing mess. Other attributes are less costly application equipment, variety of application methods, low VOCs, good appearance and protection, quick color change capability, good chemical and physical resistance and good outdoor durability.

Drawbacks to using single-component, high-solids coatings are high curing temperatures, wet paint tends to pick up dirt, more involved clean-up and booth maintenance, over-bake and recoating problems, sensitivity to marginal surface preparation and the temperature/viscosity correlation. Occasionally paint must be heated in order to be sprayed, but urethanes are heat sensitive and therefore cannot always be heated.

Other problems include sludge buildup in spray booth reservoirs. Because of this, dry filters, skimmers or cyclonic sludge-removal systems should be used. High-solids coatings obviously have more solids than solvent-bornes, hence more sludge is generated in the booth unless application transfer efficiency is optimized.

Many suppliers see a good future for single-component, high-solids coatings, while others see waterbornes replacing them.

Chlorinated-Solvent-Thinned Coatings

Solvents used in chlorinated-solvent-thinned (CST) coatings have been considered exempt from many air-pollution regulations because they do not contribute to the formation of ozone. Their exemption may soon be eradicated.

The Bush administration has proposed legislation that would reduce toxic chemical emissions by 75 pct. Nearly 190 chemicals are listed as hazardous, including 1,1,1-trichloroethane, a common solvent used to thin paint. The problem is that chlorinated solvents are believed to react similarly to chlorofluorocarbons, thus contributing to alleged global warming.

Chlorinated-solvent-thinned coatings use resins such as acrylics, alkyds, phenolated alkyds, epoxies and polyesters. Acrylics are said to have excellent exterior durability. Phenolated alkyds have excellent corrosion resistance, and when top coated with an acrylic, withstand 500 hrs salt spray. Epoxy resins provide excellent strength, durability, adhesion, chemical resistance and electrical properties.

Products finished with these coatings include industrial air compressors, air conditioning units, plastic shutters, steel posts and steel containers.

Chlorinated-solvent-thinned coatings are fast drying, have low VOCs and low viscosity. Vic Santamaria of Jamestown Paint and Varnish Co., Jamestown, Pennsylvania, believes they are essentially equal in performance to conventional solvent-borne coatings.

One significant limitation of chlorinated-solvent-thinned coatings could be their inability to meet new air-pollution regulations. Another shortcoming is their fast evaporation rate, which can result in orange peel, solvent popping and resin kickout.

Most suppliers believe chlorinated-solvent-thinned coatings will give way to water-bornes and high-solids coatings. Mr. Santamaria even predicted that chlorinated-solvent-thinned coatings will be extinct by the year 2000.

For this report, paint suppliers were asked how they viewed market penetration for various low-VOC paints now and in 1995. The sample was small, and the predictions varied. For certain categories some suppliers predicted increases in coatings use, while others predicted decreases. The suppliers responses were averaged. This will provide a general idea of their predictions for low-VOC paints. Remember, this is not a representative sample.

Market share for all water-borne coatings is predicted to increase 15 pct. Single-component, high-solids coatings are expected to decrease in market share by 16 pct. Two-com-

ponent, high-solids coatings are expected to increase market share dramatically, by 128 pct. The forecast for chlorinated-solvent-thinned is a 47 pct decrease.

Howard Ellerhorst, chairman of The Chemical Consulting Group, Cincinnati, Ohio, a global consulting firm that determines trends and market shares for the products finishing industry, stated that in the United States in 1990, 56 pct of all paints applied (solvent-borne and two-component high-solids, waterbornes, powder and radiation cure) involve low-VOC formulations. By 1997, low-VOC systems are expected to have a 65-70 pct share.

The forecast for both anodic and cathodic electrocoat is seen as favorable through 1997.

The collective growth rate for all industrial coatings from 1990-1997 is forecast at a uniform 1.7 pct per year. Low-VOC growth rate is currently predicted as a steady 3.6 pct over the next seven years. But, Mr. Ellerhorst cautions that you never know when new legislation will cause a growth spurt or decline.

What's on the Horizon?

Debates this year in Congress on the Clean Air Act Amendment will focus on three bills that concern air toxics, acid rain and ozone/carbon monoxide non-attainment. The air toxics and ozone/carbon monoxide non-attainment areas will affect finishers the most. Nearly 800 pollutants are already regulated. And 190 more are found on President Bush's air toxics proposal, including 1,1,1-trichloroethane, methylene chloride, methyl ethyl ketone and others.

According to Mr. Buonicore, the air toxics legislation requires that EPA list categories and subcategories of major and area sources of these hazardous. A major source is one emitting, or with the potential to emit, 10 metric tons/year of a single listed hazardous substance.

The ozone/carbon monoxide non-attainment legislation will focus on industries in non-attainment areas, requiring them to lower their VOC emissions. Industries targeted will be polymer and resins; auto body refinishing; truck, bus and heavy equipment manufacturing and painting; appliances, miscellaneous coated products; automobile painting; paint stripping; and architectural coatings.

Suppliers Help With Compliance. Paint suppliers continue to develop lower-VOC compliance coatings. One way finishers are trying to comply is through improved transfer efficiency, but they cannot rely on this alone. The government is lowering the limits. Finishers are concerned. Several comments made by finishers during Surface Coating '90 revealed that they are extremely concerned with the effects of air-pollution regulations. Many do not feel paint suppliers are providing the support, in terms of low-VOC coatings, that they need to stay compliant.

Isocyanates are found in polyurethane coatings, and OSHA regulates their emission. Because they react with water, they pose a significant health threat to people and the environment. One dramatic example is Bhopal, India, where an isocyanate leak killed more than 2,000 people. Even limited amounts have an effect, including breathing difficulties, skin irritation and eye tissue damage.

Several companies have developed and are developing isocyanate-free paints. MagnaClad, Inc. in El Toro, California, has developed a low-VOC water-borne polyurethane paint that contains no free-isocyanates.

Chuck Grewer of MagnaClad feels that polyurethanes never enjoyed the popularity they should have because of factors such as smell, drying time, flammability and isocyanates. The new isocyanate-free products provide the characteristics of solvent-borne polyurethanes, as well as low VOCs.

Clean Air Act Amendments are slated for debate and potential approval this year. These amendments will ensure that finishers comply with lower VOC emission rates. Improved transfer efficiency helps, but it alone will not help finishers comply. Being in a non-attainment area is not going to be beneficial. And although finishers may suffer more headaches, the government plans to ensure that it won't be because of dirty air. PF

APPENDIX D

Factsheet

Vehicle Maintenance

WHAT IS THE WASTE PROBLEM?

Vehicle maintenance facilities use a number of different hazardous materials and generate both hazardous and nonhazardous wastes. Typical vehicle maintenance activities and wastes generated include:

- cleanup of the shop area (rags, solvents)
- cleaning automotive parts (organic solvents, caustic waste waters and sludges)
- replacement of automotive fluids (waste oil, oil filters, transmission and brake fluid, antifreeze)
- replacement of non-repairable equipment (batteries, brakes, shocks, tires, mufflers, electrical components, water pumps)
- repair of fixable equipment (brake calipers/rotors/drums, alternators, fuel pumps, carburetors, power train components)
- light body work and touch-up painting (solvents, paint, paint thinner)
- fueling vehicles (leaked or spilled petroleum during fueling and from underground storage tanks)

HOW DOES THIS AFFECT YOU?

Because of the similarity in operations at Vehicle Maintenance Facilities (VMF), waste streams and waste issues are comparable to those found at the Buffalo VMF; therefore, the Buffalo facility is used as a case study to exemplify waste problems and pollution prevention opportunities.

The U.S. Postal Service Buffalo District Vehicle Maintenance Facility (VMF) maintains 1,200 vehicles each year. The vehicles range from light delivery vehicles to tractor trailer trucks. Operations at the Buffalo VMF include vehicle washing, fueling, minor body repair and painting, and engine maintenance and repair.

The hazardous materials used for VMF operations can be harmful to the workers exposed to these chemicals and can cause environmental problems, such as polluting storm water with oil, grease, fuel, and other contaminants. Handling, tracking, treating and disposing of the wide range of VMF operation wastes is time consuming and expensive. In addition, the potential legal and financial liability of improperly managed wastes or hazardous materials is also a concern.

To address these waste management issues, the Postal Service is committed to source reduction and recycling as a sound environmental practice. Source reduction is a multimedia approach that minimizes or eliminates waste released to land, air, and/or water without simply shifting pollutants from one media to another. The Postal Service considers source reduction to be the most preferred environmental management technique for dealing with a waste generation problem. For those wastes that cannot be reduced at the source, the Postal Service recommends that generators consider recycling as the next best option.

In the Postal Service Waste Reduction Guide (AS 552), the Postal Service set an overall goal to reduce waste by 25 percent from 1992 levels by December 1993 and an additional 25 percent by December 1995. Additionally, the Postal Service plans to reduce the use of the 17 hazardous chemicals that have been identified by EPA's 33/50 Program by 1995.

UNITED STATES POSTAL SERVICE

WHAT CAN YOU DO?

Various waste reduction options have been identified that can reduce or eliminate VMF wastes and help meet the Postal Service's overall waste reduction goals.

SOURCE REDUCTION

Source reduction reduces the amount of waste or the toxicity of the waste at the source, that is, before the waste is generated. This can be accomplished by improved operating and housekeeping practices, materials substitution, or process and equipment modification.

Improved operating and housekeeping practices - Procedural changes that result in reduction of wastes. These include:

- Personnel practices - Management initiatives, employee training, and employee incentives all help to promote pollution prevention and ensure proper use and handling of hazardous materials.
- Procedural measures - Proper recordkeeping, material handling and storage, material tracking, inventory control, and scheduling can prevent materials from becoming wastes.
- Loss prevention practices - Spill prevention, preventative maintenance, and emergency preparedness are very effective at reducing the amount of waste generated.

Materials substitution - Substitute hazardous substances with nonhazardous or less hazardous substances. Examples include:

- Alternatives to organic solvents include reformulated carburetor cleaner compounds, physical cleaning methods, and water-based cleaning systems.
- Use water-based paints in place of solvent-based paints. Water-based paints are formulated with considerably less solvent than solvent-based paint and cleanup with water.
- Substitute phosphate-free biodegradable detergent for standard detergents when washing vehicles.

Process and equipment modifications - Change process steps or modify equipment to reduce waste. Examples include:

- Determine how clean parts need to be prior to cleaning. Many parts require only enough cleaning for inspection.
- Use a pre-cleaning step. Cleaning efficiency can be increased by manual brushing or pre-rinsing parts before cleaning the part in a solvent or aqueous cleaner.
- Remove parts slowly from the solvent solution to reduce dragout and avoid spills. Cover the solvent sink when not in use to prevent solvent evaporation.
- Install or convert free running rinse to still rinses.
- Install vapor recovery nozzles on fuel pumps to recover fuel emissions.

RECYCLING

Recycling recovers a waste from one process and reuses it in the same or in another process in an environmentally safe manner.

Many wastes from VMF operations have the potential to be recycled or reused. These include engine oil, transmission fluids, solvents, parts washing solutions, vehicle washing wastewater, batteries, refrigerants such as CFC-12, and antifreeze solutions. Segregating wastes facilitates recycling and reuse of materials. In particular, separate nonhazardous material from hazardous wastes, oil from solvent, and non-chlorinated solvent from chlorinated solvent. Recycling alternatives range from contracting with an outside company to collect and recycle wastes, to installing and operating on-site recycling equipment.

Purchasing products made from or containing recovered material or products that can be recycled helps to create and sustain recycling markets. Federal Procurement Guidelines urge Federal agencies to establish an affirmative procurement program for recycled content products or material. Recycled items that can be used at VMFs include re-refined engine oil, antifreeze, recapped or retread tires, and solvents for parts cleaning and painting. In addition, many paper, plastic, metal, and glass products are made with recycled material or can be recycled.

ENERGY CONSERVATION

An energy audit can identify ways to conserve energy and cut energy expenditures. Some methods of reducing energy consumption include:

- Replacing old bulbs with energy efficient light bulbs
- Installing motion-sensitive lights
- Turning off lights and machines not in use
- Installing programmable thermostats

REFERENCES

The following is a list of references that provide information on applicable pollution prevention techniques, associated implementation costs, and potential source reduction gains.

1. *Waste Reduction Guide*, USPS, (AS 552), Feb. 1992
2. *Recycling Guide*, USPS (AS 550), August 1991.
3. *Hazardous Waste Guide*, USPS (AS 553), May 1992.
4. *Guides to Pollution Prevention: The Automotive Repair Industry*. USEPA, Risk Reduction Engineering Laboratory, Cincinnati, OH. 1991.
5. *Guides to Pollution Prevention: Automotive Refinishing Industry*. USEPA, Risk Reduction Engineering Laboratory, Cincinnati, OH. 1991.
6. *Waste Audit Study for Automotive Repair Shops*. California Department of Health Services - Alternative Technology Section. 1987.
7. *Hazardous Waste Reduction Assessment Handbook for Automotive Repair Shops*. California Department of Health Services - Alternative Technology Section. 1989.
8. *Fact Sheet: Ultrafiltration*. Minnesota Technical Assistance Program.
9. *Pollution Prevention Tips: Waste Reduction Options for Radiator Service Firms*. North Carolina Pollution Prevention Pays Program.
10. *Waste Reduction Information: Choosing a Still for On-site Solvent Recovery*. Minnesota Technical Assistance Program.

Funding provided by the United States Environmental Protection Agency and the United States Postal Service

APPENDIX E

ECONOMIC FEASIBILITY OF WASHWATER RECYCLING SYSTEM

Appendix E
Economic Feasibility of Washwater Recycling System

Prior to being repaired or serviced vehicles are washed using a Graco brand power washer. Large engine or vehicle parts are also washed in the power washer. Currently wash water from vehicle and large parts washing operations drain to the oil and water separator. A small capacity automatic car wash which recirculates the washwater could reduce the amount of waste water.

Several companies are marketing wash water recirculating systems including Landa and the Hotsy Corporation. A wash water recycling system collects contaminated washwater, passes it through a series of filters to remove contaminants and then recirculates the clean water for reuse. The sludge waste is collected for disposal. The system removes solids, oils and greases, and bacteria, it also adjusts the water's pH.

A recirculating system would greatly reduce water consumption and sewer use since there is no effluent from the system, the water is 100 percent reused. The amount of water used by the VMF's power washer is unknown since water use is monitored on a facility wide basis and not for specific operations. USPS personnel should consider installing a water meter to gather accurate water consumption data. Assuming that the power washer is used 4 hours a day at an average flow rate of 4 gallons per minutes, the annual use is 249,600 gallons. Even if the power washer is only used 1 hour a day the annual water use is 83,200 gallons.

Table E-1 presents a cost/benefit analysis for a wash water recycling unit. The very low water and sewer fees currently paid by the USPS make this an economically unattractive option at this time.

TABLE E-1. COST/BENEFIT ANALYSIS: WASH WATER RECYCLING SYSTEM

CAPITAL COSTS	
Hotsy RC 1000	$ 22,395
Transportation	$ 100
Installation (labor @ $25/hr, piping and electrical)	$ 4,000
Total Capital Expenditure	$ 26,495
Operating and Maintenance Costs	
Operating costs:	
Maintenance (routine, plus cost of filters)	$ 3,000
Labor ($25/hr)(130 hrs/yr)	$ 3,250
Disposal costs:	
Sludge in sump pit Spent filter socks Cartridge filter	
Total estimate $150/month	$ 1,800
Total Annual Operating and Maintenance Costs	$ 8,059
Avoided Costs	
Disposal cost	
Waste water (249,600 gal/yr)(1,000 ft^3/7,480 gal)($5.76/1,000 ft^3)	$ 192
Water consumption savings (249,600 gal)(1,000 ft^3/7,480 gal)($3.82 gal)	$ 127
Total Annual Avoided Costs	$ 319
Net Annual Benefit (NAB) = Avoided Costs - O&M	$ -7,739

Assumptions

- The VMF uses the pressure washer 4 hours a day; the average pressure water sprays at 4 gal/min (240 gal/hr); total annual water consumption is 249,600 gal/yr.
- Water rates are $3.82 per 1,000 cubic foot and sewer fees are $5.76 per 1,000 cubic feet based on billing record for January to March 1991.
- 1,000 cubic feet equals 7,481 gallons.

APPENDIX F

ACME PRODUCT INFORMATION

Automotive Finishes™

TECHNICAL DATA

NE-Prime™
Water Borne Primer-Surfacer
Gray 585

PRODUCT DESCRIPTION

NE-Prime™ 585 is a single-component, water borne primer-surfacer with a VOC as applied of 1.10 lbs/gal designed to be used in VOC regulated regions. NE-Prime™ 585 is packaged ready to spray and has excellent adhesion to steel, aluminum, fiberglass, and OEM surfaces. NE-Prime™ 585 provides excellent filling, sanding, corrosion protection, and gloss holdout. It is an ideal substitute for lacquer primer-surfacers where fast dry and quality performance are required.

TECHNICAL DATA

• Color	Gray	• Recommended dry film thickness after sanding	2.0-2.5 mils
• Flash points	>200°F TOC		
• Volume solids as applied	29.0%	• Dry time before sanding @ 75°F	30-45 min.
• VOC (Volatile Organic Content as applied)	1.1 lb./gal.	• Sandability	Excellent- no clogging of paper
		• Holdout	Very good
• Viscosity #2 Zahn	45 sec.	• Humidity resistance (500 hours)*	Good
• Lead/chromate free	Yes	• Salt spray resistance (500 hours)*	Good
• Air pressure	40-45 psi	* After one week air dry	

SURFACE PREPARATION

Bare Substrates: Steel, Galvanized Steel*, Aluminum, or Fiberglass

**Note: With the inconsistencies of galvanized steel, consult your local Acme Representative for system recommendations and substrate testing.*

1. Solvent clean with KLIX® Solvent Cleaner 88 or AQUA-KLIX™ Low VOC Surface Cleaner 87 and wipe dry with a clean, dry cloth.
2. Apply 2–3 medium coats of ETCH-LOC® Etching Filler 562 or 565† or one double coat of Vinyl Wash Primer 560.

Prepainted Substrates:

1. Wash surfaces with a mild detergent in hot water. Rinse well and wipe dry with a clean, dry cloth.
2. Solvent clean lacquer surfaces with KLIX-KRIL® Solvent Cleaner 6089. Solvent clean enamel surfaces with KLIX® Solvent Cleaner 88 or AQUA-KLIX™ Low VOC Surface Cleaner 87. Wipe dry with a clean, dry cloth.
3. Grind repair area to remove paint and all rust as needed. Fill as needed using an appropriate Acme body filler. Allow body filler to tack up and shape as needed.
4. Sand repair area and featheredge using 80, 180, 280, and finish with 320 grit treated sandpaper on a random orbital sander.
5. Apply 2-3 medium coats of ETCH-LOC® Etching Filler 562 or 565† to bare metal and body filler.

(For the above products refer to the appropriate product label or data page for complete information.)

MIXING

1. Stir or shake NE-Prime™ thoroughly before using.
2. No reduction is required as NE-Prime™ 585 is packaged ready to spray. If additional reduction is required add up to 10% ***deionized*** water to achieve 35-45 seconds #2 Zahn. ***Caution***: Do not over reduce.

NOTE: Store in full, air tight, lined containers to prevent rusting or mold growth.

APPLICATION

1. Adjust air pressure at the gun to **40-45** psi for siphon feed gun, **35-40** psi for gravity feed gun, **40-45** psi for pressure feed gun with **6-10** psi pot pressure or 8-9 psi for HVLP.
2. Spray **two or more medium wet coats** at a gun distance of 8"-10" allowing each coat to become hand slick before the next coat. Use medium coats for filling instead of heavy, wet coats to minimize film shrinkage. Recommended dry film thickness is 2.0-2.5 mils.
3. Clean spray gun with water or AQUA-KLIX™ 87 followed by lacquer thinner immediately after use.

NOTE: Do not use gun air to blow dry or cracking may occur.

RECOATING

1. Allow NE-Prime™ to dry for a minimum of 30-45 minutes before sanding. Cool temperatures or high film thickness will extend this time.
2. Finish sand with 320 grit or finer treated sandpaper. Do not wet sand. Solvent clean with KLIX-KRIL® Solvent Cleaner 6089, or follow with damp rag to ensure surface is free of sanding residue.
3. NE-Prime™ may be directly recoated after sanding with HYDRO-LOX™ Primer-Sealer 580/583† or any Acme topcoat.

†New Product — To be announced

PRODUCT AT-A-GLANCE

PRODUCT — **NE-Prime™ Water Borne Primer-Surfacer** — **Gray 585**

USE
- A fast dry, water borne primer-surfacer with a VOC as applied of 1.1 lbs/gal.
- Sands easily with no clogging of the sandpaper.
- Featheredges easily and fills 80-180 grit scratches.

SUITABLE SUBSTRATES

• Steel	• OEM lacquers	• Refinish enamels
• Aluminum	• OEM enamels	• ETCH-LOC® Etching Filler
• Fiberglass	• Refinish lacquers	• Vinyl Wash Primer

SURFACE PREPARATION
- **Wash** surfaces with a mild detergent in hot water. Rinse well and wipe dry with clean cloth.
- **Solvent clean** with an Acme solvent cleaner, and wipe dry with a clean cloth.
- **Grind** repair area to remove paint and all rust as needed.
- **Apply** an Acme **body filler** to clean bare metal as needed.
- **Sand** all areas to be refinished and featheredge all broken film areas.
- **Treat** bare metal with an appropriate Acme etching primer.

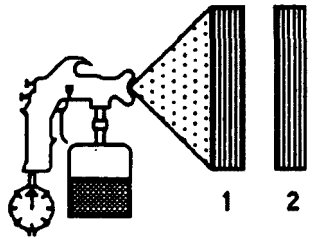
MIXING

None required — use at package consistency*

* *An additional 10% of deionized water may be added to adjust viscosity to 35-45 seconds #2 Zahn. Caution: Over-reduction will dramatically lower viscosity and sacrifice application properties.*

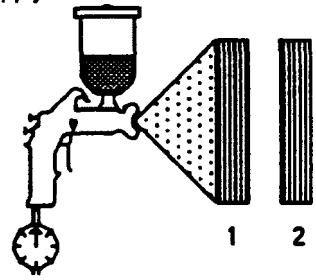
APPLICATION

Siphon feed
Apply 2 or more medium wet coats



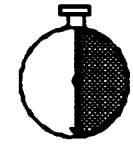
40-45 psi
(use 8-9 psi for HVLP)

Gravity feed
Apply 2 or more medium wet coats



35-40 psi

Time to Sand
30-45 minutes
(minimum)
@ 70°F



RECOAT

• HYDRO-LOX™ Primer-Sealer†	• HYDRO-LOX™ Primer-Sealer†
• LOX-SEAL™ Acrylic Sealer	• KWIK-SLIK® Primer-Sealer
• LOXON II® Urethane Sealer	• Acme Acrylic Enamel
• ProBase 10® Acrylic Urethane BC/CC	• ACME 100® Polyurethane Enamel
• ProSingle™ Acrylic Urethane	• MIRALON® Acrylic Urethane
• PRO-KRIL® Acrylic Lacquer	• MIRALON® Acrylic Urethane BC/CC
• PRO-KRIL® Acrylic Lacquer BC/CC	• FLEET-X® Enamel

NOTES
- Clean equipment immediately with water or AQUA-KLIX™ 87 followed by lacquer thinner.
- Finish sand with 320 or finer grit treated sandpaper.
- Do not blow dry with gun air or cracking may occur.
- Remove sanding residue with KLIX-KRIL® 6089 or a damp rag before recoating.
- Recommended dry film thickness is 2.0-2.5 mils after sanding.

PAINT-SAFE™

• Read all label directions before use.	• Wear a NIOSH approved dust particulate mask PS-90015 when sanding.
• Refer to MSDS for specific information.	• Wear safety goggles PS-90017, coveralls PS-90026, and latex gloves PS-90022 when using product.
• Wear a NIOSH approved organic vapor respirator PS-90000 or PS-90002 when mixing and applying.	

†New Product — To be announced

ACME Automotive Finishes

TECHNICAL DATA

ProBase 10®
High Solids, Air Dry Clearcoat 791
Low VOC (4.4 Pounds/Gallon)

PRODUCT DESCRIPTION

ProBase 10® High Solids, Air Dry Clearcoat 791 is a urethane clearcoat designed for use in the open shop or in a spray booth. The fast dry times and excellent buffability make it ideal for all shop conditions. Because 791 has higher solids, only two coats are required for 2.0 mils dry coverage. 791 delivers excellent gloss and DOI, and if required, is easily polished to remove dirt or texture. 791 is low in VOC at only 4.4 pounds/sprayable gallon.

TECHNICAL DATA

ProBase 10® High Solids, Air Dry Clearcoat 791

• Weight Solids @ the gun		44.6%	• Air pressure @ gun	
• Volume Solids @ the gun		37.8%	Siphon feed	50 psi
• VOC (sprayable)		4.4 lbs/gal	HVLP/LVLP	8-10 psi
• Mixing ratio by volume		3:1:1	• Recommended Dry Film Thickness	2.0 - 2.5 mils
Clearcoat : Reducer: Hardener			• Gloss	
• Viscosity (sprayable)	#4 Ford	13-15 sec.	@ 60°	86 minimum
	#2 Zahn	16-18 sec.	@ 20°	82 minimum
			• DOI	80 minimum

MIXING

ProBase 10® High Solids, Air Dry Clearcoat 791

- **Clearcoat Reducer:** (Choose the Clearcoat Reducer that best fits the repair size and shop temperature.)

Size of repair	792/6792 Fast	794/6794 Medium	796/6796 Slow	797 Very Slow
Small spot repairs	50 - 85°F	above 85°F	—	—
1- or 2-panel repair	50 - 70°F	70 - 90°F	above 90°F	—
Multi-panel repair	50 - 70°F	70 - 80°F	80 - 90°F	above 90°F
Complete refinishing	50 - 60°F	60 - 70°F	70 - 85°F	above 85°F

- **Mixing Clearcoat:** Mix **3** parts Clearcoat 791 to **1** part Reducer, stir, then add **1** part Clearcoat Hardener 798.
- **Mixing Flexibilized Clearcoat:** Mix **3** parts Clearcoat 791 to **1** part Clearcoat Reducer, stir, then add **1** part Clearcoat Hardener 798 and **1** part MULTI-FLEX™ Flexible Additive 68
- **Pot life of Clearcoat:** 2 hours with or without MULTI-FLEX™

APPLICATION

ProBase 10® High Solids, Air Dry Clearcoat 791:

1. Adjust air pressure at the gun to 50 psi for siphon feed or pressure feed (adjust pot pressure 5 to 10 psi). Use 8-10 psi for HVLP/LVLP with 5-6 psi at the cup.
2. Apply **only 2** wet coats at a gun distance of 8-10 inches allowing each coat to become hand slick before applying the next coat. Apply second coat of clearcoat within 45 minutes of the first to prevent possible recoat lift.
3. If extra flow is required, add up to 1 ounce of Universal Urethane Retarder 271 per sprayable quart.
4. To blend clearcoat edge, use only 794/6794 Medium Reducer using 25 psi at the gun. IMPORTANT: Clean spray gun immediately after use with Gun and Equipment Cleaner 1301.

DRYING SCHEDULE

Dry times are based on the recommended dry film thickness of 1.0-1.5 mils for basecoat color and 2.0-2.5 mils for clearcoat, thicker films will extend drying times.

- **Air dry times:**

	791 Clearcoat			
	70°F	80°F	90°F	100°F
	792/6792	794/6794	796/6796	797
Dust free	25 min.	30 min.	40 min.	40 min.
To buff	8 hours	8 hours	8 hours	8 hours
To deliver	16 hours	16 hours	16 hours	16 hours

- **Force dry times:**

	792/6792	794/6794	796/6796/797
110°F	45 min.	45 min.	45 min.
120°F	30 min.	30 min.	30 min.

2 hours after cool down, 791 can be buffed.

- If buffing of ProBase 10® Clearcoat 791 is needed due to dirt:

1. Allow the Clearcoat to cure. Sand with 1200 grit sandpaper followed by cross-sanding with 1500 grit sandpaper checking frequently with a rubber squeegee to ensure that the 1200 scratches are being removed.
2. Buff by machine with polishing pad using a quality microfinishing compound, follow with a microfinishing glaze. For ultimate in appearance, hand glaze with a soft clean cloth.

PRODUCT AT-A-GLANCE

PRODUCT — **Basecoat with ProBase 10® HS, Air Dry Clearcoat 791**

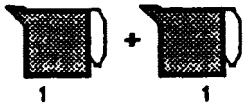
USE
- An easy-to-apply, high-gloss Acrylic Urethane System with excellent durability.
- Matches OEM basecoat/clearcoat colors.
- Uses unique Basecoat Stabilizers (Fast 780 & Standard 782) that control color blending.
- Basecoat can be recoated in as little as 10 mins. when using 780 and 20 mins. with 782.

SUITABLE SUBSTRATES
- OEM enamels
- OEM lacquers
- Aged refinishes
- High-Build Epoxy Primer
- ETCH-LOC® Etching Filler
- HS KWIK-SLIK® Primer-Sealer
- Hydro-LOX™ Primer
- LOXON II® Primer-Surfacer
- LOXON II® Sealer
- HS LOXON II® Sealer

SURFACE PREPARATION
- Wash surfaces with a mild detergent in hot water. Rinse well and wipe dry with clean cloth.
- Solvent clean with Acme solvent cleaner, and wipe dry with a clean cloth.
- Sand all repair areas to be refinished and featheredge broken film areas. Finish with 320 grit.
- Treat bare metal areas with ETCH-LOC® Etching Filler.
- Surface with Hydro-LOX® Primer-Surfacer.

MIXING

Basecoat
Stir or shake color thoroughly



1 Basecoat Color + 1 780 or 782

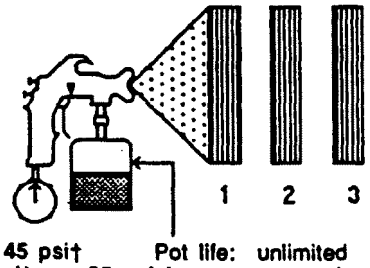
Use 780V or 782V for VOC regulated areas.

High Solids, Air Dry Clearcoat 791

3 791 + 1 792/6792 794/6794 796/6796 797 + 1 798

APPLICATION

Basecoat
Apply 2-3 medium coats.
Allow each coat to flash until hand slick before next coat.

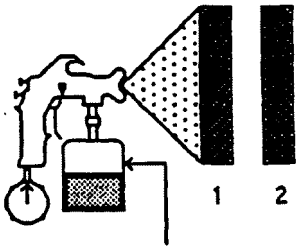


45 psi† Pot life: unlimited

Note: Use a 25 psi low pressure mist coat to even out metallic/mica colors as a final coat after hiding has been achieved.

†Use 8-10 psi for HVLP/LVLP

Clearcoat
Apply 2 wet coats.
Allow each coat to flash until hand slick before next coat.



50 psi for 791† **Pot life: 2 hours with or without 68**

RECOAT
- Recoat Basecoat color with 791.
- Recoat basecoat colors before 7 days or remove basecoat color.

NOTES
- Basecoat will appear flat when dry.
- *Do not* use fisheye killers in basecoat color as it will adversely affect the adhesion of the clearcoat.
- If fisheyes are a problem in clearcoat, add up to 1/2 ounce of URE-A-BAN Silicone Additive 71 per sprayable quart of clearcoat.
- *Do not* scuff, sand (wet or dry), or solvent clean basecoat colors. (Small areas may be wet sanded to remove dirt.)
- Add up to 1 ounce of Universal Urethane Retarder 271 to improve flow or to prevent dry edges.

PAINT-SAFE® (K)
- Read all label directions before use.
- Refer to MSDS for specific information.
- Wear an air purifying respirator PS-90000/02 when mixing and applying.
- Wear a NIOSH approved dust particulate mask PS-90015 when sanding.
- Wear safety goggles PS-90017, coveralls PS-90024/26, gloves PS-90022, shoe covers PS-90028 and air supplied respirator PS-90006/90012 when using product.

Automotive Finishes®

TECHNICAL DATA

MIRALON.3.5

Low VOC Acrylic Urethane

PRODUCT DESCRIPTION

MIRALON® 3.5 Low VOC Acrylic Urethane is a high performance acrylic urethane that has a maximum VOC (Volatile Organic Compounds) content of 3.5 pounds/gallon sprayable (420 grams/liter). MIRALON® Low VOC is available as an intermix system with a wide color selection.

When MIRALON® 3.5 Low VOC is used with Hydro-LOX™ Waterborne Primer 580, Fleet and Original Equipment Manufacturers have a VOC "system" to comply with regulations limiting coatings to a maximum VOC of 3.5 pounds/gallon (420 grams/liter) of sprayable material. Refer to your local, state, or federal regulatory agencies for further details.

TECHNICAL DATA

• Mixing ratio by volume	3:1
• VOC (maximum sprayable)	3.5 lbs/gal 420 g/liter
• Viscosity (sprayable)	
#4 Ford Cup	20-25 sec.
#2 Zahn Cup	23-26 sec.
• Flash point (average) - Tag Open Cup	80°F
• Coverage @ 1 mil dry (white)	919 sq. ft./gallon
• Recommended dry film thickness (2 coats)	2.0-2.5 mils
• Gloss 60°	90
20°	80
• DOI (Average)	80
• Pencil Hardness at 1 week dry	HB - H
• Dielectric strength over steel (white)	1800 volts/mil (dry)

• Performance after one week air dry	
- Impact resistance (80 in/lbs)	
direct	Pass
indirect	Pass
- Flexibility (1/8" conical mandrel)	Pass
- Solvent resistance (MEK/Toluene/Gasoline/Oil)	No effect
-Chemical resistance (24 hr. contact)	
10% Hydrochloric acid	No effect
10% Sulfuric acid	No effect
10% Ammonium hydroxide	No effect
- Salt spray resistance -250 hrs	No effect
- Humidity resistance - 100 hrs	No effect
- QUV, accelerated weathering - 1,000 hrs(92% retention for white)	Excellent

SURFACE PREPARATION

Bare Substrates: Steel, Galvanized Steel*, Aluminum, or Fiberglass

**Note: With the inconsistencies of galvanized steel, consult your local ACME Representative for system recommendations and substrate testing.*

1. Solvent clean with KLIX® Solvent Cleaner 88 or AQUA-KLIX™ Low VOC Surface Cleaner 87 and wipe dry with a clean, dry cloth.
2. Treat bare steel areas with FERRO–PREP™ Steel Cleaner 2414 followed by CHEM–GRIP® Phosphate Conversion Coating 2415. Treat bare aluminum with Acme Metal Cleaner and Conditioner 285. Or apply 2-3 medium coats of ETCH–LOC® Etching Filler 562/565 or one double coat of Vinyl Etching Primer 560.
3. Follow with High Build Epoxy Primer 131/132, Hydro-LOX™ Waterborne Primer 580, LOXON II® Sealer 156/159, or KWIK-SLIK® Primer-Sealer 129/134/135.

Prepainted Substrates:

1. Wash surfaces with a mild detergent in hot water. Rinse well and wipe dry with a clean cloth.
2. Solvent clean lacquer surfaces with KLIX–KRIL® Solvent Cleaner 6089. Solvent clean enamel surfaces with KLIX® Solvent Cleaner 88 or AQUA-KLIX™ Low VOC Surface Cleaner 87. Wipe dry with clean cloth.
3. Grind off paint and remove all rust. Fill as needed using a ACME body filler. Allow body filler to tack up and shape as needed. Body filler must be cured before priming.
4. Sand repair area and featheredge using 80, 180, 280, and finally 320 grit treated sandpaper on a random orbital sander.
5. Apply 2-3 medium coats of ETCH–LOC® Etching Filler 562/565 to bare metal and featheredge area. Check local regulations to verify etching primers are VOC exempt.
6. Follow with Hydro-LOX™ Waterborne Primer 580.

(For the above products refer to the appropriate product data page for complete information.)

MIXING

1. Stir or shake MIRALON® 3.5 Low VOC thoroughly before mixing.
2. Mix 3 parts MIRALON® 3.5 Low VOC Color with 1 part MIRALON® Low VOC Hardener 723. See your Acme representative about further reduction of MIRALON® Low VOC Color for specific applications. **Pot life:** 2-3 hours @ 70°F.
3. Stir thoroughly and strain before use.

NOTE: If fisheyes are a problem, add up to 1/2 oz. of URE–A–BAN® Silicone Additive 71 to 1 quart of ready-to-spray MIRALON® Low VOC Color.
Avoid use of MIRALON® Accelerator in MIRALON® Low VOC Color, it will significantly shorten pot life (as short as 1/2 hour @ 70°F).

APPLICATION

1. For proper results use only the following equipment recommendations. Conventional siphon feed equipment may not yield proper appearance. Check equipment by applying MIRALON® 3.5 Low VOC to a test panel before using.

- **Pressure Feed:** Apply one medium crosscoat for non-metallics. Metallic colors require two medium coats with a 3-5 minute flash-off between coats, followed immediately by a light crosscoat to even out metallic mottling.

Gun:	JGA 502	Fluid Delivery:	19-22 ounces/minute
Fluid Tip:	FF or FX	Atomizing air psi:	65-75 psi @ gun
Air Cap:	797	Gun Distance:	10-12 inches

- **Electrostatic:** Apply one medium coat followed by a second medium coat perpendicular to direction of first coat. The second coat may be applied immediately after the first coat.

Binks Model 85B		Kremlin KMP Conventional		Nordson AN8 Conventional	
Fluid Tip:	63B	Fluid Tip:	#15 (.055")	Fluid Tip:	0.060"
Needle:	63AE	Air Cap:	33	Air Cap:	987
Air Cap:	PW	Atomizing air psi:	65-75 psi @ gun	Atomizing air psi:	65-75 psi @ gun
Atomizing air psi:	35-45 psi @ gun	Fluid Pressure:	25-30 psi	Fluid Delivery:	12-16 oz./min.
Fluid Delivery:	6 oz./min.	Kilovolts	75 KV	Kilovolts	60-75 KV
Kilovolts	60 KV	Gun Distance:	10-12 inches	Gun Distance:	10-12 inches
Gun Distance:	10-12 inches				

2. Normally two coats of MIRALON® 3.5 Low VOC Acrylic Urethane are sufficient for complete hiding. If a third coat is required for hiding, allow second coat to flash 20-30 minutes, or until hand slick. Apply third coat wetter than the second coat.

DRYING SCHEDULE

Dry times are based on the recommended dry film thickness of 2.0 mils; thicker films will extend drying times.

- **Air dry times** (Using **722*** MIRALON® Low VOC Mixing Clear only) @ 75°F and 50% R.H.:

- Dust free	40-60 min.
- Tack free	3-4 hours
- Tape free	4-6 hrs.

Note:** *Light colors of MIRALON® 3.5 Low VOC using 722 Mixing Clear may be force dried at a **maximum temperatures of 120°F.
*Dark colors of MIRALON® 3.5 Low VOC using 722 Mixing Clear may be force dried at a **maximum temperature of 100°F.** Higher temperatures may cause hazing.*

- **Force dry times** (Using **724** MIRALON® Low VOC Mixing Clear only):

Note: See your local ACME Representative for availability of 724.

Temperature	Tape free
Do not use below 140°F	—
140°F	1.5 - 2.5 hours
160°F	60 minutes
180°F	30 minutes

Note: After force drying, allow vehicle to cool down 10-15 minutes before removing from booth.

NOTES

1. Recoating of MIRALON® 3.5 Low VOC Acrylic Urethane may take place at any time without a recoat lift problem. If film is allowed to dry for more than 48 hours, scuff sand with 320 grit or finer treated sandpaper before recoating.
2. Decals may be applied after 72 hours and before one week air drying at 75°F. Lower temperatures, heavy film thickness, poor air movement, thick decals, foil-based decals, etc., will extend the 72 hour dry time before decal may be applied. After one week, scuff sand for proper decal adhesion. Refer to your local ACME Representative for recommendations.
3. If force dry equipment cannot achieve 140°F do not use 724. Use 722, following the above air dry recommendations.

PRODUCT AT-A-GLANCE

PRODUCT MIRALON® 3.5 Low VOC Acrylic Urethane

USE

- Complies with VOC regulations for a maximum VOC content of 3.5 lbs./gallon (sprayable).
- A high performance, extremely durable, high-gloss acrylic urethane.
- Withstands harsh industrial environments and chemicals.
- Ideal as an OEM finish and refinish coating for fleets, trucks, and special vehicles.

SUITABLE SUBSTRATES

- Hydro-LOX™ Waterborne Primer *
- ETCH–LOC® Etching Filler†
- High Build Epoxy Primer†
- LOXON II® Primer-Surfacer†
- LOXON II® Sealer†
- KWIK–SLIK®†

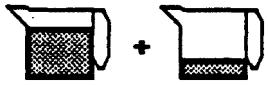
*VOC Compliant @ 2.0 lbs/gal. (240 grams/liter) † Consult local regulations for VOC requirements

SURFACE PREPARATION

- **Wash** surfaces with a mild detergent in hot water. Rinse well and wipe dry with clean cloth.
- **Solvent clean** with a Acme solvent cleaner, and wipe dry with a clean cloth.
- **Treat** bare metal with a Acme conditioner or etching primer. Check local regulations to verify etching primers are VOC exempt.
- **Prime** with High Build Epoxy Primer 131/132, Hydro-LOX™ Waterborne Primer 580, LOXON II® Sealer 156/159, or KWIK-SLIK® Primer-Sealer 129/134/135.

MIXING

- Stir or shake MIRALON® Low VOC Color thoroughly before mixing.
- Mix by volume **3** parts of MIRALON® Low VOC Color with **1** part 723 Hardener.

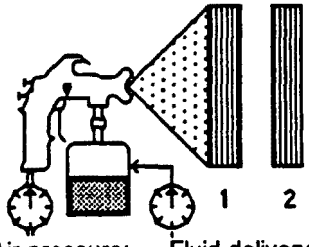


3 Color + **1** 723

- Pot life: **2 - 3** hours

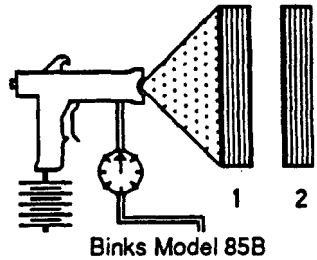
APPLICATION

Pressure feed*
Apply **1** medium coat for solid colors, **2** medium coats for metallic colors with a 3-5 minute flash.



Air pressure: 65 – 75 psi
Fluid delivery: 19-22 oz./min.

Electrostatic*
Apply **2** medium coats.
Flash off is not necessary.



Binks Model 85B
Kremlin KMP Conventional
Nordson AN8 Conventional

*For complete equipment recommendation see APPLICATION on previous page.

RECOAT

- MIRALON® Low VOC can be recoated at any time.
- Decals may be applied after 72 hours and before 1 week. After 72 hours scuff sand for proper adhesion. Extend dry time in cool temperatures or if using large, thick, or foil backed decals.

NOTES

- When MIRALON® Low VOC is to be force dried at 140 to 180°F use only 724 MIRALON® Low VOC Mixing Clear. *Note: See your local ACME Representative for availability of 724.*
- After force drying, allow vehicle to cool down 10-15 minutes before removing from booth.
- For air dry applications use 722 MIRALON® Low VOC Mixing Clear.
- If fisheyes are a problem, add up to 1/2 ounce of URE–A–BAN® Silicone Additive 71 per sprayable quart.

PAINT SAFE®

- Read all label directions before use.
- Refer to MSDS for specific information.
- Wear positive-air respirator PS–90006 or 90012 when mixing and applying.
- Wear a NIOSH approved dust particulate mask PS–90015 when sanding.
- Wear safety goggles PS–90017, coveralls PS–90026, and latex gloves PS–90022 when using product.

ACME Automotive Finishes

TECHNICAL DATA

Hydro-LOX™
Low VOC Undercoat System

Base Epoxy Primer 580
Primer-Sealer Activator 583
Primer-Surfacer Activator 584

PRODUCT DESCRIPTION

Hydro-LOX™ Undercoat System is composed of Hydro-LOX Base Epoxy Primer 580 that can be activated with Hydro-LOX Primer-Sealer Activator 583 to form Hydro-LOX Primer-Sealer, or Hydro-LOX Primer-Surfacer Activator 584 to form Hydro-LOX Primer-Surfacer. Hydro-LOX is a two-component, water reducible, epoxy based undercoat system designed to provide excellent adhesion and corrosion protection without flash rusting, and with a VOC as applied of 2.0 lbs/gallon (maximum).

TECHNICAL DATA

- Color: Light Gray, Med. Gray, Dark Gray

Base Epoxy Primer 580
Sealer Activator 583
Surfacer Activator 584

	Hydro-LOX Primer-Surfacer 580/584	Hydro-LOX Primer-Sealer 580/583
• Flash points	>230°F	>230°F
• Volume solids as applied	37.1%	46.8%
• VOC as applied	2.0 lbs/gal.	2.0 lbs/gal.
• Viscosity #2 Zahn	31 sec.	32 sec.
• Lead/chromate free	Yes	Yes
• Coverage @ 1 mil dry per sprayable gallon	600 sq. ft.	750 sq. ft.

	Hydro-LOX Primer-Surfacer 580/584	Hydro-LOX Primer-Sealer 580/583
• Recommended dry film thickness	2.0-2.5 mils	1.3-1.7 mils
• Topcoat holdout	Excellent	Excellent
• Humidity resistance* (96 hrs)	Excellent	Excellent
• Corrosion resistance* (250 hrs.)	Excellent	Excellent
• Impact resistance* - direct	160 in. lbs.	160 in. lbs.
• Flexibility* (1/4" conical mandrel)	Pass	Pass

* After one week air dry

SURFACE PREPARATION

Bare Substrates: Steel, Galvanized Steel, Aluminum, or Fiberglass

Note: *With the inconsistencies of galvanized steel, consult your local Acme Representative for system recommendations and substrate testing.*

1. Solvent clean with KLIX® Solvent Cleaner 88 or AQUA-KLIX™ Low VOC Surface Cleaner 87 and wipe dry with a clean, dry cloth.
2. Apply 2–3 medium coats of ETCH-LOC® Etching Filler 562 or 565*, or one double coat of Vinyl Wash Primer 560 for steel substrates. For aluminum, remove oxidation by sanding with 280 grit on a random orbital sander. (Fiberglass does not require pre-treatment primer.)
   Note: Avoid using directly over shot/sand blasted steel without a pre-treatment primer.

Prepainted Substrates:

1. Wash surfaces with a mild detergent in hot water. Rinse well and wipe dry with a clean, dry cloth.
2. Solvent clean lacquer surfaces with KLIX-KRIL® Solvent Cleaner 6089. Solvent clean enamel surfaces with KLIX Solvent Cleaner 88 or AQUA-KLIX Low VOC Surface Cleaner 87. Wipe dry with a clean, dry cloth.
3. Grind repair area to remove paint and all rust as needed. Fill as needed using an appropriate Acme body filler. Allow body filler to tack up and shape as needed.
4. Sand repair area and featheredge using 80, 180, 280, and finish with 320 grit treated sandpaper on a random orbital sander.
5. Apply 2-3 medium coats of ETCH-LOC® Etching Filler 562 or 565* to bare metal and body filler.

(For the above products refer to the appropriate product label or data page for complete information.)

* New Product — to be announced.

MIXING
(No induction time required)

1. Stir Hydro-LOX thoroughly before using.
2. **Hydro-LOX Primer-Surfacer** (pot life is 24 hours at 70°F)

Hydro-LOX Primer-Sealer (pot life is 6 hours at 70°F)

* Add up to 10% deionized water to achieve 32 seconds in #2 Zahn.

APPLICATION

Hydro-LOX Primer-Surfacer 580/584

1. Adjust air pressure at the gun to **40-45** psi for siphon feed or 8-9 lbs. for HVLP with a fluid delivery of 11 oz./minute. (Extra reduction of 5% deionized water to 28 seconds #2 Zahn will increase breakup for HVLP.) For pressure pot, use Devilbiss JGA (or equivalent) with .070" orifice, EX tip, and 264 air cap with a fluid delivery rate of 10-12 oz./minute.
2. Apply 2-3 medium coats at a gun distance of 8-10 inches allowing each coat to become hand slick before next coat.

Hydro-LOX Primer-Sealer 580/583

1. Adjust air pressure to 50-55 lbs. for siphon feed or 9-10 lbs. for HVLP with a fluid delivery rate of 12 oz./minute. For pressure pot, use Devilbiss JGA (or equivalent) with .070" orifice, EX tip, and 264 air cap with a fluid delivery rate of 10-12 oz./minute.
2. Apply 1 medium coat at a gun distance of 8-10 inches.

Note: Do not use gun air to blow dry or cracking may occur. Clean up immediately with water followed by a 1:1 alcohol (isoproponal) and water solution and finish with lacquer thinner. Do not use below 65°F as film will not cure properly.

RECOATING

Hydro-LOX Primer-Surfacer 580/584

1. Allow to dry for 30 minutes at 70°F or force dry for 15 minutes at 120°F. (Do not force dry above 140°F.)
2. Finish sand with 320 grit or finer, depending on topcoat, treated sandpaper. Solvent clean with KLIX-KRIL® 6089 Solvent Cleaner or AQUA-KLIX Low VOC Surface Cleaner 87 to ensure surface is free of sanding residue.
3. Recoat with Hydro-LOX Primer-Sealer 580/583, MIRALON® Single-Stage Acrylic Urethane, MIRALON Low VOC, MIRALON Basecoat, ProBase 10® Basecoat, ProSingle™ Acrylic Urethane, Acme Acrylic Enamel with hardener, ACME 100® Polyurethane Enamel, FLEET-X® Synthetic Enamel with hardener, or PRO-KRIL® Acrylic Lacquer.

Hydro-LOX Primer-Sealer 580/583

1. Allow to dry 8 hours at 70°F or force dry for 60 minutes at 140°F or 30 minutes at 180°F.*
2. Recoat with MIRALON® Single-Stage Acrylic Urethane, MIRALON Low VOC, MIRALON Basecoat, ProBase 10 Basecoat, ProSingle Acrylic Urethane, Acme Acrylic Enamel with hardener, ACME 100 Polyurethane Enamel, FLEET-X Synthetic Enamel with hardener, or PRO-KRIL Acrylic Lacquer.

Note: Refer to manufacturer's maximum force dry temperature recommendations before force drying.

PRODUCT AT-A-GLANCE

PRODUCT **Hydro-LOX Low VOC Undercoat System**

Base Epoxy Primer 580
Primer-Sealer Activator 583
Primer-Surfacer Activator 584

USE

- Low VOC water-borne primers with a VOC as applied of 2.0 lbs/gal.
- Sand Hydro-LOX Primer-Surfacer in 30 minutes at 75°F.
- Recoat Hydro-LOX Primer-Sealer in 60 minutes at 140°F.

SUITABLE SUBSTRATES

- Steel
- Aluminum
- Fiberglass
- OEM lacquers
- OEM enamels
- Refinish lacquers
- Refinish enamels
- ETCH-LOC® Etching Filler
- Vinyl Wash Primer

SURFACE PREPARATION

- **Wash** surfaces with a mild detergent in hot water. Rinse well and wipe dry with clean cloth.
- **Solvent clean** with an Acme solvent cleaner, and wipe dry with a clean cloth.
- **Grind** repair area to remove paint and all rust as needed.
- **Apply** an Acme **body filler** to clean bare metal as needed.
- **Sand** all areas to be refinished and featheredge all broken film areas.
- **Treat** bare metal with an appropriate Acme etching primer.

MIXING

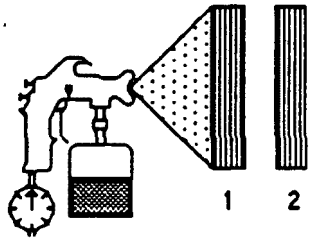
3 (580) + 1 (583)* 1 (580) + 4 (584)

* An additional 10% of deionized water may be added for extra flow if needed. ***Caution***: Over-reduction will dramatically lower viscosity and sacrifice application properites.

APPLICATION

Siphon feed

Apply 2 or more medium wet coats



40-45 psi for Hydro-LOX Primer-Surfacer (8-9 psi for HVLP)
50-55 psi for Hydro-LOX Primer-Sealer (9-10 psi for HVLP)

Time to Sand or Recoat

- Hydro-LOX Primer-Surfacer — 30 minutes to sand

- Hydro-LOX Primer-Sealer — 60 minutes @ 140°F or 8 hours @ 70°F to recoat.

RECOAT

- ProBase 10® Acrylic Urethane BC/CC
- ProSingle™ Acrylic Urethane
- PRO-KRIL® Acrylic Lacquer
- PRO-KRIL® Acrylic Lacquer BC/CC
- Acme Acrylic Enamel
- ACME 100® Polyurethane Enamel
- MIRALON® Acrylic Urethane
- MIRALON® Acrylic Urethane BC/CC
- MIRALON® Low VOC
- FLEET-X® Enamel

NOTES

- Clean immediately with water followed by 1:1 alcohol and water solution, and finish with lacquer thinner.
- Finish sand Hydro-LOX Primer-Surfacer with 320 or finer grit sandpaper.
- Remove sanding residue with KLIX-KRIL® 6089 or AQUA-KLIX™ 87 before recoating.
- **Do not blow dry with gun air or cracking may occur.**
- Recommended dry film thickness for primer-surfacer is 2.0-2.5 mils after sanding.

PAINT-SAFE™

- Read all label directions before use.
- Refer to MSDS for specific information.
- Wear a NIOSH approved organic vapor respirator PS-90000 or PS-90002 when mixing and applying.
- Wear a NIOSH approved dust particulate mask PS-90015 when sanding.
- Wear safety goggles PS-90017, coveralls PS-90026, and latex gloves PS-90022 when using product.

TECHNICAL DATA

Automotive Finishes®

TECHNICAL DATA

AQUA-KLIX™
Low VOC Surface Cleaner
87

PRODUCT DESCRIPTION

AQUA-KLIX™ Low VOC Surface Cleaner 87 is a water based emulsion that contains a surface active "detergent" and a special blend of solvents. It is designed to remove oil, grease, wax, silicone, and other surface contaminants, as well as sanding residue from bare metal and plastic; OEM topcoats and primers; and refinish undercoats to prepare surface for painting. When used on plastic substrates, AQUA-KLIX™ minimizes static build-up.

TECHNICAL DATA

- VOC-as packaged 1.40 #'s/gal (168 g/l)
- -as packaged less water & exempt compounds 8.30 #'s/gal (996 g/l)
- Mixing ratio Use at package consistency
- Freeze hazard Yes
- Weight/gallon 8.3 #'s/gal
- Solids by weight <0.7%
- pH 10 (alkaline)
- Flash point >199°F TCC

SURFACE PREPARATION

1. Wash surfaces to be painted and adjacent panels with a mild detergent and water solution to remove heavy deposits of dirt, oil, and grease.

MIXING

None — use at package consistency.

APPLICATION

1. Saturate a clean cloth with AQUA-KLIX™ 87.
2. Apply to areas to be painted and adjacent panels. Wipe surface thoroughly with AQUA-KLIX™ 87 and apply only to small areas at any one time.
3. Wipe off with a second clean, dry cloth before AQUA-KLIX™ 87 is allowed to dry. If drying occurs, repeat application.

Note: In cooler temperatures and high humidity, step 3 may be needed to be repeated to remove AQUA-KLIX™ 87. Or, after step 3, blow clean, dry air across the surface to enhance the evaporation of AQUA-KLIX™ 87.

NOTES

1. On lacquer surfaces, avoid prolonged contact with AQUA-KLIX™ 87 or softening will occur. If this occurs, allow surface to dry thoroughly before next step. (A light sanding may be needed if AQUA-KLIX™ 87 has swelled the lacquer surface.)
2. Best results are obtained when temperatures are maintained above 70°F when using AQUA-KLIX™ 87.
3. Avoid prolonged contact with bare metal and dry thoroughly to prevent flash rusting.
4. Protect AQUA-KLIX™ 87 from freezing. If this occurs, allow AQUA-KLIX™ 87 to warm slowly to room temperature before use.

A1473 Rev. 4/92

APPENDIX G

VENDOR INFORMATION

Appendix G
Equipment Supplier Information

Disclaimer: Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

HVLP Paint Application Systems

Binks Manufacturing Company
1 Chapin Rd.
Pine Brook, NJ 07058-9719
201-575-6660

Graco, Inc.
P.O. Box 1441
Minneapolis, MN 55440-1441
sales: 1-800-367-4023
technical assistance:
800-543-0339

Accuspray
26881 Cannon Road
P.O. Box 391525
Cleveland, OH 44139
800-321-5992

Low VOC, High Solids Paints

Acme Automotive Finishes
101 Prospect Ave
Cleveland, OH 44115
216-566-3031

Gun Washer System

Graco, Inc.
P.O. Box 1441
Minneapolis, MN 55440-1441
sales: 1-800-367-4023
technical assistance: 800-543-0339

Aqueous Cleaners and Parts Washing Equipment*

Gary Hartline, General Sales Manager
OCS Manufacturing, Inc.
P.O. Box 370
429 Madera St.
San Gabriel, CA 91778-0370
818-458-2471

C & H Chemical
222 Starkey St
St. Paul, Minn. 55107
612-227-4343

Mirachem
2113 East Fifth St
Tempe, AZ 85281-3034
602-966-3030

Kleer-Flo*
15151 Technology Dr.
Eden Prairie, MN 55344
800-328-7942

* supplier of aqueous parts washing equipment

Solvent Recycling Unit

Finish Thompson Inc.
921 Greengarden Rd.
Erie, PA 16501-1591
814-455-4478

Binks Manufacturing Company
1 Chapin Rd.
Pine Brook, NJ 07058-9719
201-575-6660

PBR Industries
400 Farmingdale Rd.
West Babylon, NY 11704
516-422-0057

Fluids Testing Equipment

Northern Instruments Corp.
6680 N. Highway 49
Lino Lakes, MN 55014
612-784-1250

Antifreeze

(Recycling)
Glyclean
Distributor:
FPPF Chemical Co., Inc.
117 W. Tupper St.
Buffalo, NY 14201
800-735-3773

Kleer-Flo
15151 Technology Dr.
Eden Prairie, MN 55344
800-328-7942

(Distillation)
Finish Thompson Inc.
921 Greengarden Rd.
Erie, PA 16501-1591
814-455-4478

Wash Water Recycling System

Landa Inc.
13705 NE Airport Way
Portland, OR 97230
503-255-5980

Hotsy on the Hudson
145 Palisade St.
Dobbs Ferry, NY 10522
914-693-3997

APPENDIX H

ANALYSIS OF ALTERNATIVE COATINGS

Appendix H

Analysis of Alternative Coatings

Additional information necessary for an in-depth analysis of switching to an alternative coating system is provided below.

Calculating Coating Usage, Solid Waste and VOC Emissions from Coating Operation

Coating Usage: assuming that the volume of coating solids must remain constant to maintain a certain production level, coating usage can be calculated as follows:[1]

$$CU = SA / PS \times TE$$

where: SA = coating solids applied
PS = percent solids by volume at the gun
TE = transfer efficiency of gun

assumes coating formulation of 32 percent solids, 5.0 lbs of VOC released per gallons of coating.

Solid Waste: solid waste associated with the coating operation

$$SW = 5.5 \ (CU) \ (PS) \ (1 - TE)$$

where: CU = coating usage
PS = percent solids by volume at gun
TE = transfer efficiency

VOC Emissions: VOCs emitted as a result of the coating operation; the amount of VOC emitted depends on coating usage and percent VOC in the coating.

APPENDIX I

ONSITE DISTILLATION RECYCLING UNIT INFORMATION

Waste Minimization Program

On-Site Solvent Recovery Stills

factsheet

Background on the Distillation Process

Stills are equipment used in the distillation of chemical mixtures. Distillation is a separation process that requires that the components of a mixture possess unique boiling points. The two basic steps of distillation are vaporization and condensation.

Vaporization involves heating the mixture to the boiling point of the solvent desired until the liquid becomes a gas. By controlling the temperature of vaporization it is possible to selectively recover one or more solvents from a mixture. For solvents that have a high boiling point, the solvents are distilled at reduced pressures (sometimes near vacuum) to lower the temperature needed to boil the solvent. This process, vacuum distillation, requires additional equipment.

During condensation, the vapor, known as the overhead product, is passed through a cooling system called a condenser where the vapor is condensed to a liquid product. The remaining material in the still, referred to as the still bottoms, must be disposed of as hazardous waste.

Applications of Solvent Recovery Stills

Small quantity generators of solvent waste frequently use batch processing in 'kettle' type stills to recover their solvent waste. Batch process distillation involves feeding the waste to the still in a batch. No additional solvent waste can be added to the system until the original batch is completed.

Batch stills are frequently used for solvent recovery in the following settings:

- **Autobody Repair:** to recover paint thinner
- **Automotive Repair:** to recover parts cleaners
- **Drycleaners:** to recover drycleaning solvent

Large quantity generators of solvent waste use continuous distillation systems as opposed to batch systems. Continuous systems are those which continuously are fed waste solvent and likewise continuously produce the recovered solvent. Continuous stills are able to recover large amounts of solvent faster than batch stills. However, continuous stills require that large amounts of solvent waste be fed to it in order to be cost effective.

Continuous stills are frequently used in solvent recovery in these settings:

- **Chemical Manufacturing:** to recover solvent by-products
- **Paint Stripping:** to recover dirty paint strippers
- **Parts Degreasing:** to recover degreasing solvents

Purchasing Guidelines for On-Site Solvent Recovery Stills

THE FOLLOWING LIST OF EQUIPMENT PURCHASING CONSIDERATIONS WAS DEVELOPED BY THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES TO HELP WISCONSIN BUSINESSES IDENTIFY AND EVALUATE CURRENT HAZARDOUS WASTE MINIMIZATION OPPORTUNITIES. ALTHOUGH IT IS NOT POSSIBLE TO COVER EVERY ASPECT OF EQUIPMENT SELECTION, THE LIST COVERS SOME OF THE MORE IMPORTANT POINTS AND PROVIDES CONSIDERATIONS FOR EVALUATING SOLVENT RECOVERY STILLS.

Is a still a feasible method for your company to recycle its solvent waste?

1) Is the solvent to be reclaimed a pure solvent or a solvent blend? *[A blended solvent frequently yields a distillation product that differs in composition from the solvent fed to the still]*

2) Are there components found in the distilled solvent that will make it unsuitable for use in its original capacity?

3) If the distilled product is not suitable for its original use, is there another use for the solvent in your facility?

4) Will it be possible to implement a waste segregation policy in your facility? *[Preventing the mixing of waste solvents is essential in developing an effective solvent recovery program.]*

5) Does the solvent that you use contain Nitrocellulose? *[Nitrocellulose is found in some inks and lacquers;it is explosive when it is dried,and should not be distilled!]*

What type of still is best for you?

1) Is the capacity of the distillation unit adequate for your needs?

2) Is the boiling point of your solvent within the designed temperature range for the still or will you need to distill at reduced pressure?

3) Does the still operate on a batch or a continuous basis?

4) Will the waste solvent need to be treated to remove solids before it is fed to the still? *[A high solids content may foul some types of equipment.]*

5) Will the materials used in the construction of the still *[e.g. stainless steel, teflon, etc.]* resist deterioration from the solvent the still will process?

6) Are the still bottoms to be removed automatically or manually?

What type of still is best for you? (continued)

7) Is the still heated by an electric element, hot oil, or steam? *[The best method of heating should be evaluated with respect to both safety and cost effectiveness.]*

8) Is the solvent vapor cooled and condensed by chemical coolant, water, or forced air? *[Some solvent vapors are cooled more efficiently by water and coolant as opposed to air.]*

9) Will fractioning columns be necessary to separate components of the condensing vapor? *[Fractioning columns help to separate components that have relatively close boiling points.]*

Other considerations

1) Will the manufacturer demonstrate the efficiency of the still by distilling a sample of your waste?

2) Are the safety features of the still sufficient for the work environment at your facility?

   - Are the electrical switches and controls explosion proof?
   - Can the unit be secured to prevent it from being opened until it has cooled to a safe temperature?
   - Is the unit designed to shut down safely if the maximum operating temperature or pressure is exceeded?
   - Will the unit shut down safely if there is a failure in the water or electrical utility supply?

3) What is the anticipated volume of still bottoms that you expect to generate and what are the associated costs of disposal? *[Still bottoms are considered a hazardous waste.]*

4) Will the still require a modification of the ventilation system at your facility? *[Solvent recovery hoods may be installed to collect fugitive emissions.]*

5) Will the operation of the still affect your compliance with local, state, or federal environmental or health and safety regulations?

6) What are the energy requirements for the still? Is it energy efficient?

Some of the purchasing guidelines have been adapted from a Minnesota Technical Assistance Program (MnTAP) fact sheet on On-Site Solvent Recovery Stills. The DNR would like to thank MnTAP for its contribution.

On-Site Solvent Recovery Stills Manufacturer and Supplier List

August 1991

THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DNR), THROUGH THE WISCONSIN HAZARDOUS WASTE MINIMIZATION TECHNICAL ASSISTANCE PROGRAM, DEVELOPED THE FOLLOWING LIST OF MANUFACTURERS AND SUPPLIERS OF SOLVENT DISTILLATION EQUIPMENT. THE LIST SHOULD NOT BE CONSIDERED TO BE COMPLETE IN ITS LISTING OF MANUFACTURERS OR SUPPLIERS. THIS LIST IS NOT AN ENDORSEMENT OF ANY OF THE SPECIFIC MANUFACTURERS OR SUPPLIERS. HAZARDOUS WASTE GENERATORS ARE ADVISED TO THOROUGHLY EVALUATE THE SERVICES AND COMPLIANCE STATUS OF ANY COMPANY THAT THEY USE TO MANAGE THEIR HAZARDOUS WASTE. THE LIST WILL BE PERIODICALLY UPDATED. IF YOU HAVE ANY ADDITIONS OR CORRECTIONS FOR THIS LIST, PLEASE CONTACT THE HAZARDOUS WASTE MINIMIZATION TECHNICAL ASSISTANCE PROGRAM AT (608) 267-3763.

<u>Manufacturer</u>

Acra Electric Corp.
3801 N. 25th Avenue
Schiller Park, Il 60176
Phone: (708) 678-8870
Fax: (708) 678-8889

Artisan Products
73 Pond Street
Waltham, MA 02254
Phone: (617) 893-6800
Fax: (617) 647-0143

Baron-Blakeslee/Allied Signal
2001 N. Janice Avenue
Melrose Park, IL 60160
Phone: (708) 450-3900
Fax: (708) 450-3884
Attn: Bob Block

B/R Instrument Corp.
P.O. Box 7
Pasadena, MD 21121
Phone: (612) 452-5695
(800) 922-9206

Branson Ultrasonic
41 Egale Road
Danbury, CT 06813
Phone: (203) 796-0400

<u>Distributor/Sales Rep.</u>

C&H Supply
400 S. 5th Street
Milwaukee, WI

White Cleaning Equipment
P.O. Box 1073
Waukesha, WI 53187
Phone: (414) 521-3152
Attn: Dave Pagor

Bob Block
Phone: (708) 450-3900

Ann Cole
12861 Hamlet Ave.
Apple Valley, MN 55124
Phone: (612)

Schuette Ind. Sales
P.O. Box 943
Waukesha, WI 53187
Attn: Tom Riddle
Phone: (414) 549-0050

Manufacturer	Distributor/Sales Rep.
Brighton Corporation 11861 Mosteller Road Cincinnati, OH 45241 Phone: (513) 771-2300 Fax: (513) 772-2404 Attn: Ken Lutz	**Fred Hickey Corp.** 9601 River Street Schiller Park, IL 60176 Phone: (708) 678-2777
Crest Ultrasonics Corp. Scotch Road, Mercer County Airport Trenton, NJ 08628 Phone: (609) 883-4000 Fax: (609) 883-6452	**David Arata** 525 Westin Street Hoffman Estates, IL 61094 Phone: (708) 843-2139
DCI International 1229 Country Club Road Indianapolis, IN 46234 Phone: (317) 271-4001 Fax: (317) 271-1044	**Bob Zopf** Phone: (317) 271-4001
Detrex Corporation P.O. Box 5111 Southfield, MI 48086 Phone: (313) 358-5800 Fax: (313) 358-5803	
Finish Engineering Co. 921 Greengarden Road Erie, PA 16501-1591 Phone: (814) 455-4478	**Dove Equipment Co.** 4831 Colt Rd. Rockford, IL 61109 Phone: (815) 87-8900
	Recovery Equipment Corp. P.O. Box 75 Mequon, WI 53092 Phone: (414) 242-9410
Gardner Machinery Co. P.O. Box 33818 Charlotte, NC 38233 Phone: (704) 372-3890 Fax: (704) 342-0758 Attn: Pat Russell	**Pat Russell** Phone: (704) 372-3890
Giant Distillation and Recovery 900 N. Westwood Avenue Toledo, OH 43606 Phone: (414) 531-4600	**Wisconsin Compressed Air** 3056 W. Meinecke Avenue Milwaukee, WI 53210 Phone: (414) 442-0280
Hoffman/Clarkson Ind. P.O. Box 548 East Syracuse, NY 13057-0548 Phone: (315) 437-0311 Attn: Earl Stone	**Earl Stone** Phone: (315) 437-0311

Manufacturer	Distributor/Sales Rep.
Hoyt Corporation 251 Forge Road Westport, MA 02790 Phone: (508) 636-8811 Fax: (508) 636-2088	**Michael Morely** Rt. #3, Box 217 Slatington, PA 18080 Phone: (215) 767-7622
Interel Corp. P.O. Box 4676 Englewood, CO 80155 Phone: (303) 773-0753	
Kontes Scientific Glassware/Instruments P.O. Box 729 Vineland, NJ 08360 Phone: (609) 692-8500 Fax: (609) 692-3242	**Cynthia Halstead** 259 Mary Street Winnetka, IL 60093 Phone: (708) 835-3392
Lenan Corporation 615 North Parker St. Janesville, WI 53545 Phone: (800) 356-9424 In Wi (608) 752-1601	**Energy Sales Products** 515 St. Lawrence Avenue Janesville, WI 53545 Phone: (608) 752-0195
Luwa Corporation Process Division P.O. Box 16348 Charlotte, NC 28297 Phone: (704) 394-8341 Fax: (704) 392-8507	**Ralph Scully** 2407 Worthing Drive Suite 101 Naperville, IL Phone: (708) 305-8693
O-I/Schott Process Systems 1640 Southwest Blvd. Vineland, NJ 08360 Phone: (609) 692-4700 Fax: (609) 692-5619 Attn: John Jaworski	**Liquiflow, Inc.** 1201 National Ave. Addison, IL 60101 Phone: (708) 543-4080 Attn: Mitch Brach
PBR Industries 400 Farmingdale Road West Babylon, NY 11704 Phone: (516) 422-0057	**Quality Auto Body Supply** 129 Vine Street La Crosse, WI 54601 Phone: (608) 782-4552
Phaudler Company 100 West Avenue Rochester, NY 14692 Phone: (716) 235-1000 Fax: (716) 423-9644	**Mark Cody** Phone: (708) 244-8363 or **Todd Pollack** Phone: (313) 739-4311

Manufacturer

Progressive Recovery
1976 Congressinal Dr.
St. Louis, MO 63146
Phone: (314) 567-7963
Attn: Joe Miller

Renzmann, Inc.
Max Detweiler Corp.
13420 Reese St., West
Huntersville, NC 28078
Phone: (704) 875-1200

Siva International
Recyclene/Disti
405 Eccles Avenue
South San Francisco, CA 94080
Phone: (415) 589-9600

Unique Industries
P.O. Box C4530
Pacoima, CA 91333-4530
Phone: (818) 890-1133

Venus Products
1862 Ives Avenue
Kent, WA 98032
Phone: (206) 854-2660

Distributor/Sales Rep.

Midwest Environmental
N88 W16751 Appleton Ave.
Menomonee Falls, WI 53051
Phone: (414) 253-2299
Attn: Mike Kleinhans

Arthur Collier
13420 Reese St. West
Huntersville, NC 28078
Phone: (416) 433-0363

Waste-Tech, Inc.
1931 Industrial Drive
Libertyville, IL 60048
Phone: (708) 367-5150
Fax: (708) 367-1787

Phoenix-Erin
487 Willsher Drive
Fond du Lac, WI 54935
Attn: Don White
Phone: (414) 922-2936

Northwest Fiberglass
3055 Columbia Ave. NE
Minneapolis, MN 55418
Phone: (800) 544-1388

Hazardous Waste Minimization Program
Wisconsin Department of Natural Resources
P.O. Box 7921(SW/3)
Madison, WI 53707
(608) 267-9523 or
(608) 267-3763

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