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WASTE MINIMIZATION OPPORTUNITY ASSESSMENT

A TRUCK ASSEMBLY PLANT

by

Science Applications International Corporation
McLean, Virginia 22102

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Project Officer

Mary Ann Curran
Pollution Prevention Research Branch
Risk Reduction Engineering Laboratory
Cincinnati, Ohio 45268

RISK REDUCTION ENGINEERING LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

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FOREWORD

Today's rapidly developing and changing technologies and industrial products and practices frequently carry with them the increased generation of materials that, if improperly dealt with, can threaten both public health and the environment. The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. These laws direct the EPA to perform research to define our environmental problems, measure the impacts, and search for solutions.

The Risk Reduction Engineering Laboratory is responsible for planning, implementing, and managing research, development, and demonstration programs to provide an authoritative, defensible engineering basis in support of the policies, programs, and regulations of the EPA with respect to drinking water, wastewater, pesticides, toxic substances, solid and hazardous wastes, and Superfund-related activities. This publication is one of the products of that research and provides a vital communication link between the researcher and the user community.

The Waste Minimization Branch of the Risk Reduction Engineering Laboratory has instituted the Waste Reduction Assessment Program to identify, evaluate and demonstrate waste minimization opportunities in industrial and commercial operations. This report is a waste minimization assessment of a truck assembly plant.

E. Timothy Oppelt, Director
Risk Reduction Engineering Laboratory

ABSTRACT

This report summarizes work conducted at a truck assembly plant under the U.S. Environmental Protection Agency's (EPA) Waste Reduction Assessment Program (WRAP) Program. This project was funded by EPA and conducted in cooperation with the truck assembly plant.

The purposes of the WRAP Program are to identify new technologies and techniques for reducing wastes from industrial processes used by selected sites and to enhance the adoption of pollution prevention/waste minimization through technology transfer. New techniques and technologies for reducing waste generation are identified through waste minimization opportunity assessments and may be further evaluated through joint research, development, and demonstration projects.

A waste minimization opportunity assessment was performed which identified areas for waste reduction at a truck assembly plant. The study followed procedures in the EPA Waste Minimization Opportunity Assessment Manual. Although the facility has made substantial progress to date, opportunities were identified for further action. This report identifies potential options to achieve further waste minimization progress.

A number of waste generating processes were initially screened. Detailed technical evaluations were performed on wastes associated with degreasing of frame rails (chassis); spray painting; and phosphating of miscellaneous parts (E-Coat). Options identified were as follows: Option 1 – Paint Solids Dewatering and Water Recycle, Option 2 – Improve Transfer Efficiency, Option 3 – Procedural and Small-Equipment Changes, Option 4 – Reduce Paint Mix Volume, Option 5 – Minimize Contamination of Degreasing Solvent, Option 6 – Ion Exchange Recycle of Rinse Waters and Option 7 – E-Coat Line Bath Maintenance. All were evaluated during the feasibility analysis phase except for Option 3. The study concludes that the best options appear to be Option 4, Option 5, and Option 2.

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ACKNOWLEDGEMENTS

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SECTION 1

PROJECT OVERVIEW

PURPOSE

The purpose of this project was to develop waste minimization (WM) plans for a truck assembly facility using the Environmental Protection Agency's (EPA) Waste Minimization Opportunity Assessment Manual (625/7-88/003). This manual provides a systematic planned procedure for identifying ways to reduce or eliminate waste.

PROCEDURES

The project was initiated with a survey of the facility. This survey was also used as a starting point for applying the waste minimization assessment procedures. These procedures consist of four major steps (Figure 1): 1) Planning and Organization - organization and goal setting; 2) Assessment - careful review of a facility's operations and wastestreams and the identification and screening of potential options to minimize waste; 3) Feasibility Analysis - evaluation of the technical and economic feasibility of the options selected and subsequent ranking of options; and 4) Implementation - procurement, installation, implementation, and evaluation. This project completed the first three steps of the procedures for various manufacturing processes used at the facility.

The waste minimization opportunity assessment manual contains a set of 19 worksheets which are designed to facilitate the WM assessment procedure. Table 1 lists the worksheets, according to the particular phase of the program in which they are employed, and a brief description of the purpose of the worksheets. A selected combination of Worksheets 1 through 16 were completed for the wastestreams during this project and are contained in Appendices A, B and C.

The focus of the waste minimization procedures for this project was on spray painting, degreasing and phosphating operations.

A waste minimization opportunity assessment was conducted at the truck assembly plant by an assessment team composed of staff from the facility, EPA personnel, and EPA's contractor, Science Applications International Corporation (SAIC). The assessment phase of the project was initiated with a two-day survey conducted by engineers from SAIC. The survey focused on the collection of process and waste data and the identification of procedures for waste management. This time period was also used to interview operators and to solicit waste minimization ideas through brain storming exercises. During the survey, the assessment team completed many sections for Worksheets 2 through 11.

After completion of the survey, the SAIC team continued to collect data and information from the facility through telephone contacts. This time period was also used to verify data and to resolve any informational discrepancies. SAIC then completed the assessment and feasibility analysis phases of the WM assessment (Worksheets 10 through 16).

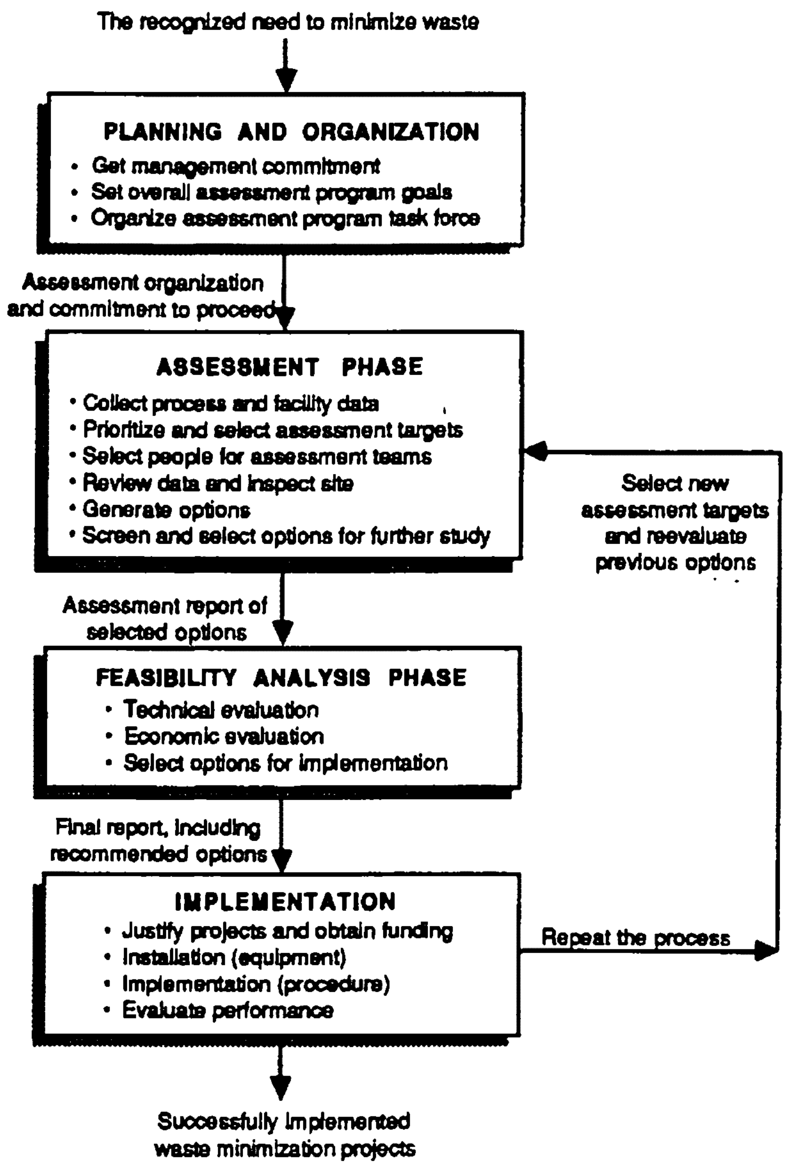

Figure 1. The Waste Minimization Assessment Procedure

TABLE 1. LIST OF WASTE MINIMIZATION ASSESSMENT WORKSHEETS

Phase	Number and Title	Purpose/Remarks
	1. Assessment Overview	Summarizes the overall procedure.
Step 1 - Planning and Organization (Section 2)	2. Program Organization	Records key members in the WMA program task force and the WM assessment teams. Also records the relevant organization.
	3. Assessment Team Make-up	Lists names of assessment team members as well as duties. Includes a list of potential departments to consider when selecting the teams.
Step 2 - Assessment Phase	4. Site Description	Lists background information about the facility, including location, products and operations.
	5. Personnel	Records information about the personnel who work in the area to be assessed.
	6. Process Information	This is a checklist of useful process information to look for before starting the assessment.
	7. Input Materials Summary	Records input material information for a specific production or process area. This includes name, supplier, hazardous component or properties, cost, delivery and shelf-life information, and possible substitutes.
	8. Products Summary	Identifies hazardous components, production rate, revenues, and other information about products.
	9. Individual Wastestream Characterization	Records source, hazard, generation rate, disposal cost, and method of treatment or disposal for each wastestream.

(continued)

TABLE 1. (Continued)

Phase	Number and Title	Purpose/Remarks
Step 2 - Assessment Phase (continued)	10. Wastestream Summary	Summarizes all of the information collected for each wastestream. This sheet is also used to prioritize wastestreams to assess.
	11. Option Generation	Records options proposed during brainstorming or nominal group technique sessions. Includes the rationale for proposing each option.
	12. Option Description	Describes and summarizes information about a proposed option. Also notes approval of promising options.
	13. Options Evaluation by Weighted Sum Method	Used for screening options using the weighted sum method.
Step 3 - Feasibility Analysis Phase	14. Technical Feasibility	Detailed checklist for performing a technical evaluation of a WM option. This worksheet is divided into sections for equipment-related options, personnel/ procedural-related options, and materials-related options.
	15. Cost Information	Detailed list of capital and operating cost information for use in the economic evaluation of an option.
	16. Profitability Worksheet #1 Payback Period	Based on the capital and operating cost information developed from Worksheet 15, this worksheet is used to calculate the payback period.
	17. Profitability Worksheet #2 Cash Flow for NPV and IRR	This worksheet is used to develop cash flows for calculating net present value (NPV) or internal rate of return (IRR).
Step 4 - Implementation	18. Project Summary	Summarizes important tasks to be performed during the implementation of an option. This includes deliverable, responsible person, budget, and schedule.
	19. Option Performance	Records material balance information for evaluating the performance of an implemented option.

ORGANIZATION OF REPORT

This report contains four sections and three appendices. Section 1 provides an overview of the project. Section 2 describes the processes surveyed during this project, and the waste management procedures employed at the facility. Section 3 presents the results of the assessment phase, including the selection of WM options. Section 4 contains the results of the feasibility analysis phase, including recommendations. Appendices A, B, and C present the WM worksheets completed for the facility. The planning and organizational worksheets (2 and 3) are contained in Appendix A. The worksheets applicable to the assessment phase (4 through 13) are presented in Appendix B. The feasibility analysis worksheets (14, 15 and 16) are contained in Appendix C.

SECTION 2

SITE DESCRIPTION

GENERAL DESCRIPTION OF THE TRUCK ASSEMBLY PLANT

This section contains a description of the site selected for this waste minimization project.

Facilities and Operating Procedures

The facility produces trucks and specializes in custom paint colors and designs. This facility assembles five different models. The production processes are primarily related to assembly and painting while the majority of the components of the vehicles are manufactured at other sites.

Production is done on one main assembly line which begins with the chassis (frame rails) and ends with a ready-to-start truck. Associated assembly/finishing procedures such as cab painting, door assembly, phosphating of small parts, etc., are done on small assembly lines which incorporate their finished work into the main assembly line. The assembly line is continuously moving and a tight schedule is required to produce the specified number of trucks in one 8-hour period.

Management and Personnel

The plant employs over 1,000 people. Production is primarily done on one shift.

PRODUCTION PROCESSES

The various manufacturing activities are located in a concentric manner around the main assembly line. At the outer ring, raw materials are stored outside of the building near the basic fabrication processes in which they are used. These processes in turn deliver parts to the assembly lines. The fabrication processes include cab building, trimming and painting, chassis or frame production, machining, engine preparation, and hydraulic/pneumatic line preparation (air piping). These lines feed the final assembly line.

The remainder of this section describes the production processes selected for this assessment.

Degreasing of Frame Rails (Chassis)

The Chassis is degreased in a booth just prior to entering the chassis paint booth. Chlorinated solvent is sprayed on using a hand held spray wand which enables workers to remove oil and grease from hard to reach areas. Solvent is also wiped onto easily accessible portions of the chassis using rags dipped into a bucket of solvent. The solvent along with the oil and grease drips off of the chassis or is blown off and evaporates from the floor. The chassis then moves into the chassis paint booth. Figure 2 is a work flow diagram of the degreasing operation.

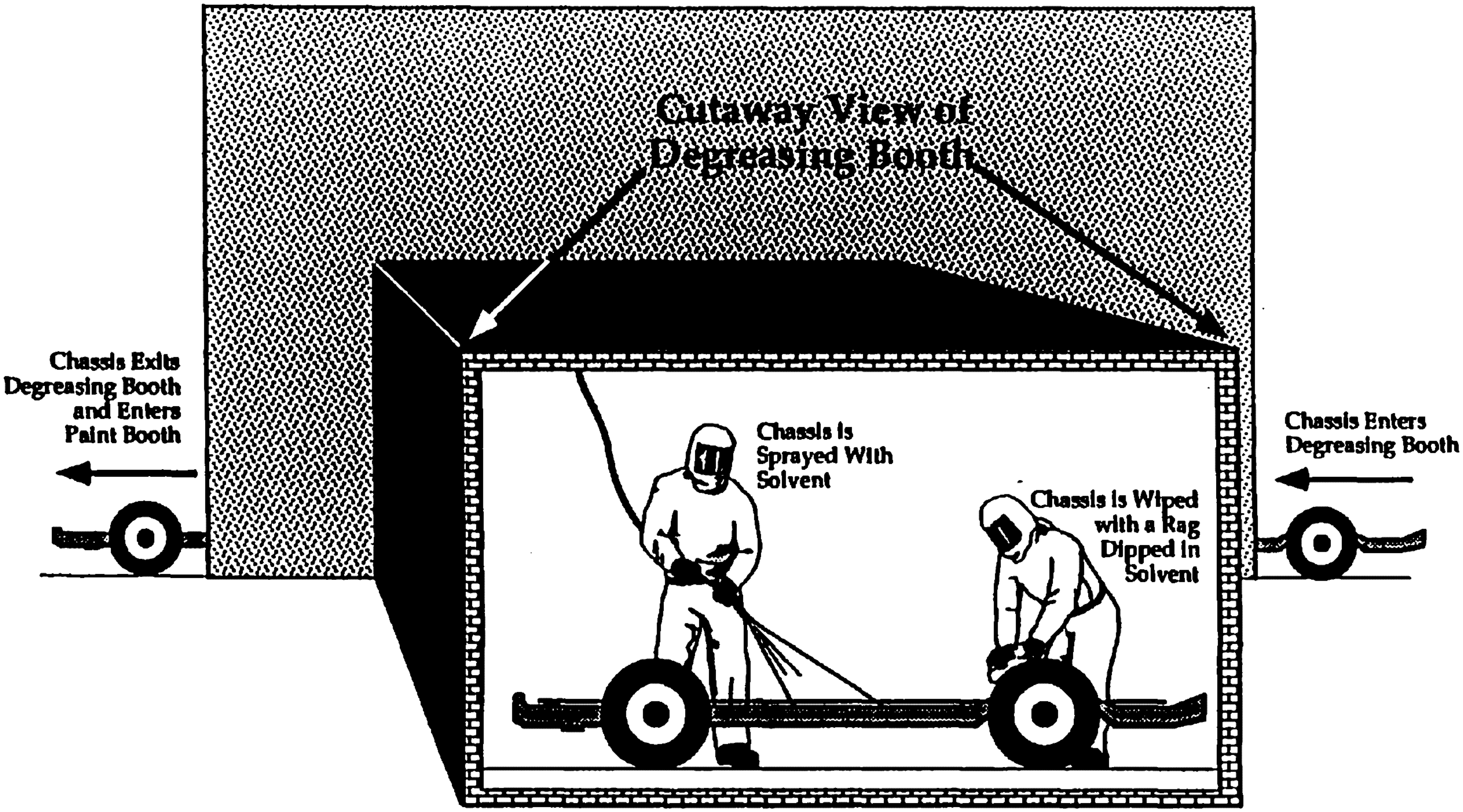

Figure 2. Work Flow Diagram--Chassis Degreasing

Prior to 1989, the solvent used in the degreasing operation was nonhazardous and no disposal records were kept. Currently, the solvent used for chassis degreasing is formulated with 90 percent 1,1,1-trichloroethane and 10 percent methylene chloride. Early in 1989, the facility used 100 percent 1,1,1-trichloroethane. The switch in solvents was made for quality reasons.

Spray Painting

The facility has paint booths dedicated to the painting of cabs, chassis', and for touch-up. The touch-up booths were not included in this assessment. The other booths are semi-enclosed rooms with downdraft water pit systems for capturing paint overspray.

The cab paint booths operate with painters working in each booth. Cabs are wheeled into the paint booths on carts that are moved by the automatic mechanism in the floor. They are then painted with two coats of paint. Cabs are automatically wheeled out of the booth and dried in a paint booth oven where the temperature is controlled to protect the fiberglass and plastic.

The chassis paint booth operates with painters. The frame rails (chassis) are wheeled into the paint booth. They are then painted on all sides. The chassis is then dried in a paint booth oven where the temperature is controlled to protect the fiberglass and plastic.

Figure 3 is a work flow diagram of the spray painting process.

The facility converted from conventional solvent paints to high solid paints on all trucks in 1989. This includes most primers and top coats for cabs and chassis paints. The decision to use high solids paints was based on the need to meet standards for volatile organic carbon (VOC) air emissions. The present permit limits the plant to 154 tons of VOC emissions per year.

Most of the paints used at this facility are solvent-based plural (two component) systems (an exception is the interior cab booth which uses a non-solvent paint). Single component solvent paints cannot be used on most of the truck assemblies because of the high usage of plastics and fiberglass in fabrication of the parts (mainly cabs). The single component paints, which are used widely in the automotive industry, require greater application temperatures which can damage the fiberglass and plastic parts.

The facility is in the process of converting from the "hot potting" method of component mixing (i.e., the two paint components are premixed in the spray painting pot) to use of equipment which allows the catalyst component to be injected and mixed at the gun during application. Paints mixed with the hot potting method have a pot life of approximately 3 hours at 72°F. With the catalyst injection system the paints have an indefinite lifespan. The leftover paint can therefore be used at a later time for touchup work. At present, the chassis booth and two cab booths are using the injection mixing.

All spray painting equipment used at the facility is the air assisted airless type. The guns in the chassis booth have been converted to high volume-low pressure guns. They operate at approximately 11 psi. Locks have been placed on the air regulators to prevent operators from using a higher pressure. The result of using lower pressures is a smaller quantity of paint overspray. The guns used in cab painting also have been modified. The painting pressures were reduced from 60 psi to 40 psi by installing new air caps. All paints are heated to reduce viscosity, which also allows for use of lower air pressures.

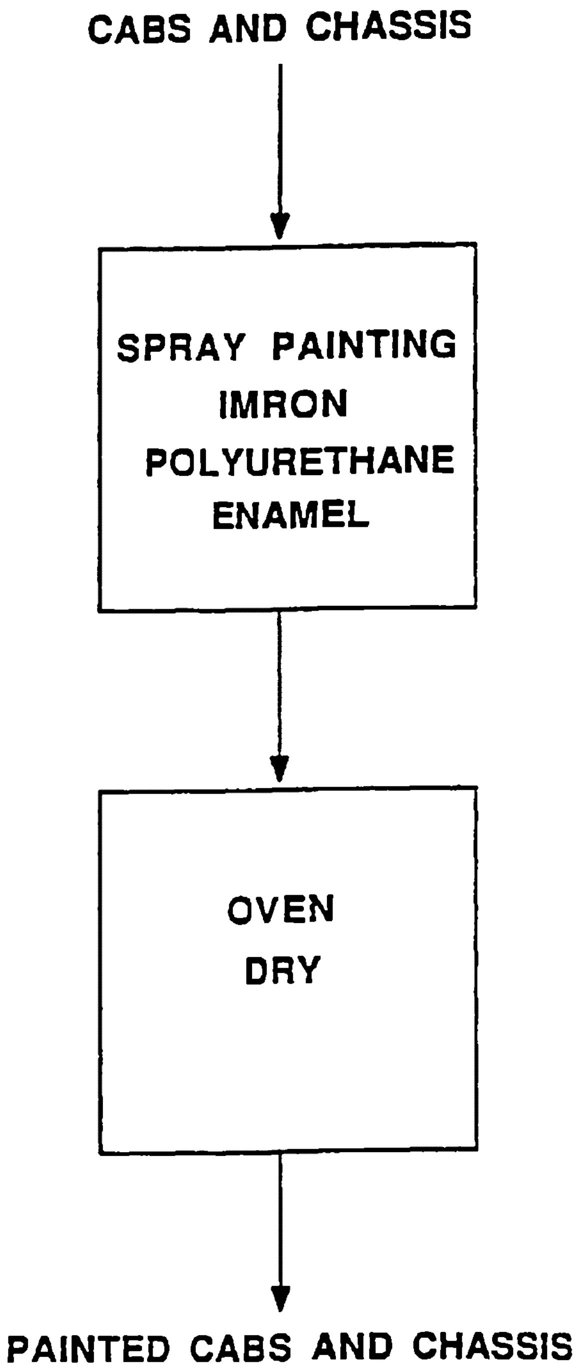

Figure 3. Work Flow Diagram–Spray Painting

Phosphating of Miscellaneous Parts (E-Coat)

An automated phosphating (conversion coating) process and electro-coat painting (E-Coat) is employed for small and medium sized steel parts. This line consists of several processing and rinsing steps. Parts are attached to an overhead conveyor belt with hooks. They are then positioned above the process tanks by the operator who manually controls the movement of the conveyor belt. The tanks are then lifted up to the parts to immerse them in solutions. The parts are immersed for several minutes and then the tanks are lowered. Parts are allowed to drip over the tanks for several minutes and then are moved on to the next process tank. After the last step (E-Coat) the conveyor moves the parts through a drying oven and then returns the parts to the beginning of the line where the operator removes them and they are taken to the assembly areas. Figure 4 is a work flow diagram of the phosphating process. Tank 1 is an initial cleaning step which removes oil and grease and other surface contaminants from the parts. Cleaning improves paint adhesion and corrosion protection. Tank 2 is a hot rinse. Tank 3 contains disodium phosphate with titanium added as a surface activator. Tank 4 contains the zinc phosphating solution. A fluoride based chemical is added to this solution to precipitate aluminum and prevent spoiling of the phosphate bath. A pH adjustment chemical (phosphoric acid) is also added to tank 4. Tank 5 is an ambient temperature rinse. Tank 6 is a nonchromium sealer. Tank 7 is a deionized water rinse. Tanks 8, 9, and 10 contain the E-coat solution.

WASTE GENERATION AND CHARACTERIZATION

The facility closely tracks the generation of wastes at its facility. Waste data for the years 1987 to 1989 are shown in Table 2. The facility has seen a significant decrease in the overall volume of waste generated and the associated disposal and transportation costs. The purpose of this project was to develop waste minimization options that can further reduce the volume of waste generated. This project has focused on the wastes generated during spray painting, degreasing (chassis) and phosphating (E-Coat) operations.

Table 2 lists eight industrial wastes generated at the plant, five of which are hazardous by EPA standards.

The production processes and wastestreams were coded during the project to provide a means of identification throughout the WM assessment. Table 3 provides a description of the code system. Processes are coded 01 through 03. Wastestreams are coded A through H. Process codes are combined with waste codes to identify specific wastestreams. The wastes selected for this assessment are listed in Table 4 and described in the following subsections.

Degreasing of Frame Rails (Chassis) Wastes

The chassis is degreased in a booth prior to entering the chassis paint booth. A chlorinated solvent is used because of the immediate drying action and VOC emissions. The solvent is both sprayed and wiped on the chassis. The waste generated during degreasing comes from the wiping process. The rags are dipped into a bucket of solvent and used to wipe down the chassis. When not in use, the rags are left soaking in the solvent, which becomes contaminated with oil and grease from the dirty rags and is dumped into a drum to await disposal. The dirty rags are sent to an industrial laundry (Simco) and are reused at the facility.

Early in 1989, 100 % 1,1,1-trichloroethane was used as the degreasing solvent. During the course of 1989 a switch to 90 % 1,1,1-trichloroethane/ 10 % methylene chloride solvent was made for quality reasons. The switch to a combined solvent has increased the disposal cost by a factor of four, while the quantity of waste solvent generated has increased by a factor of 1.4.

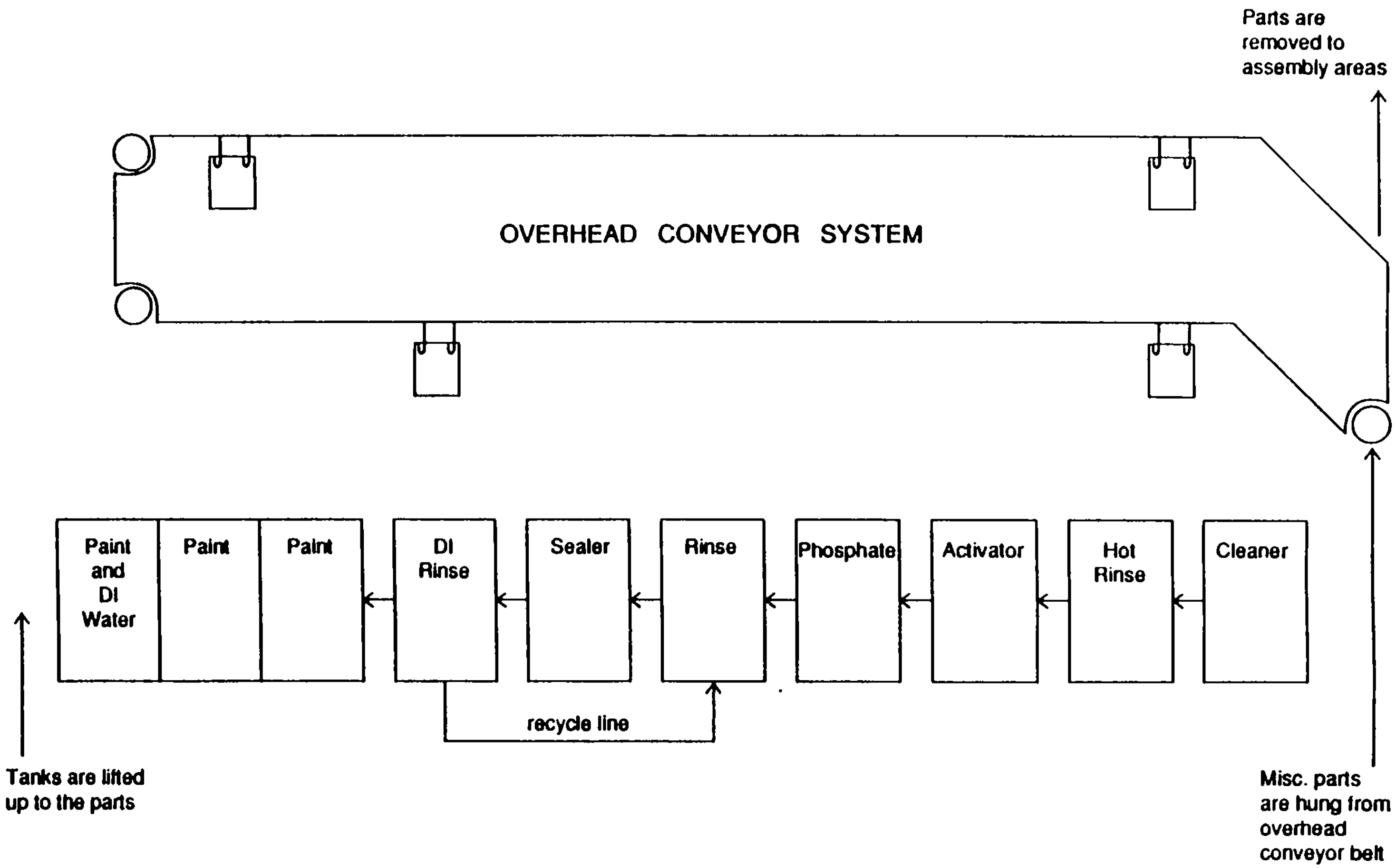

Figure 4. Work Flow Diagram–Phosphating (E-Coat) Operation

TABLE 2. SUMMARY OF WASTE GENERATION AND DISPOSAL COSTS AT THE TRUCK ASSEMBLY PLANT

	1987	1988	1989[†]
Trucks Built	5,845	7,721	8,630
Quantity of Industrial Waste Generated (lb)			
Chassis Degreasing			
Old Solvent (100% TCA)*	NA	NA	8,510
New Solvent (90% TCA)*	NA	NA	11,700
Spray Painting Wastes			
Waste Paint and Still Bottoms*	162,793	173,496	224,360
Detackified Paint Sludge	1,348,725	972,260	523,100
Pretreatment Sludge*	91,440	77,640	96,440
Heavy Drums*	31,600	8,440	0
Undercoating*	NA	NA	3,775
Used Oil	24,920	29,450	37,635
Floor Dry & Pigs	NR	NR	8,620
Total	1,659,478	1,261,286	914,140
Normalized Quantity (lb/truck)			
Chassis Degreasing			
Old Solvent (100% TCA)*	NA	NA	1.0
New Solvent (90% TCA)*	NA	NA	1.4
Spray Painting Wastes			
Waste Paint and Still Bottoms*	27.9	22.5	26.0
Detackified Paint Sludge	230.7	125.9	60.6
Pretreatment Sludge*	15.6	10.1	11.2
Heavy Drums*	5.4	1.1	0.0
Undercoating*	NA	NA	0.4
Used Oil	4.3	3.8	4.4
Floor Dry & Pigs	NR	NR	1.0
Total	283.9	163.4	105.9
Disposal & Transportation Costs ($)			
Chassis Degreasing			
Old Solvent (100% TCA)*	NA	NA	$2,087
New Solvent (90% TCA)*	NA	NA	$8,644
Spray Painting Wastes			
Waste Paint and Still Bottoms*	$81,103	$56,074	$14,552
Detackified Paint Sludge	$37,166	$28,219	$16,647
Pretreatment Sludge*	$11,279	$17,743	$12,338
Heavy Drums*	$50,513	$11,430	$0
Undercoating*	NA	NA	$2,879
Used Oil	$1,430	$1,106	$165
Floor Dry & Pigs	NR	NR	$8,644
Total Cost for Industrial Wastes	$181,491	$114,573	$60,688
Total Cost of Hazardous Waste Only	$142,895	$85,247	$40,501
Normalized Cost ($/truck)			
Chassis Degreasing			
Old Solvent (100% TCA)*	NA	NA	$0.24
New Solvent (90% TCA)*	NA	NA	$1.00
Spray Painting Wastes			
Waste Paint and Still Bottoms*	$13.88	$7.26	$1.69
Detackified Paint Sludge	$6.36	$3.65	$1.93
Pretreatment Sludge*	$1.93	$2.30	$1.43
Heavy Drums*	$8.64	$1.48	$0.00
Undercoating*	NA	NA	$0.33
Used Oil	$0.24	$0.14	$0.02
Floor Dry & Pigs	NR	NR	$0.39
Total Cost of all Industrial Wastes	$31.05	$14.84	$7.03
Hazardous Waste Cost	$24.45	$11.04	$4.69

* Hazardous Wastes By EPA Standards.
† 1989 data are estimated.
NA - Not Applicable
NR - Not Reported

TABLE 3. PROCESS AND WASTESTREAM CODES

Process	Process Code
Spray Painting	01
Degreasing	02
Phosphating (E-Coat)	03
Waste Type	Waste Code
Waste Paint - Liquid	A
Waste Paint - Solid	B
Detackified Paint	C
Paint Booth Water	D
Degreasing Solvent	E
Rinse Waters	F
Spent Process Solutions (Cleaner, Activator and Sealer)	G
Phosphate Bath and Tank Bottoms	H

TABLE 4. WASTE DISPOSAL PRACTICES AT THE FACILITY FOR SELECTED WASTES

Process	Wastestream (Code)	RCRA Regulatory Classification	Disposal Frequency	Disposal Practice
Spray Painting	Waste Paint - Liquid (01-A)	Flammable Waste UN1993 F003/F005	90 Days	Fuel Blending at Cement Kiln Facility
	Waste Paint - Solid (01-B)	Flammable Waste UN1993 F003/F005	90 Days	Incineration at Commercial TSDF
	Detackified Paint (01-C)	None	4 to 6 Weeks	Commercial TSDF
	Paint Booth Water (01-D)	None	Daily	Onsite Pretreatment; POTW*
Degreasing of Frame Rails (Chassis)	Degreasing Solvent (02-E)	F001/F002/D006/D007	90 Days	Fuel Blending at Ecolotec-A Division of Stout Environmental
Phosphating of Misc. Part (E-Coats)	Spent Process Solutions (Cleaner, Activator & Sealer) (03-G)	None	2 Weeks	Onsite Pretreatment; POTW*
	Rinse Waters (03-F)	None	Daily	Onsite Pretreatment; POTW*
	Phosphate Bath and Tank Bottoms (03-H)	None	Annually	Commercial TSDF-Tricil Environmental

* Onsite pretreatment produces a sludge which is sent to a hazardous waste landfill. The treated water is discharged to a publicly owned treatment works (POTW).

Spray Painting Wastes

The two major spray painting processes include the painting of cabs and frame rails (chassis). The wastes generated during spray painting operations include: paint waste (liquid and solid), detackified paint, and paint booth water. A description of each waste follows.

Paint wastes include: 1) unused spray paint (approximately one-third of total), and 2) still bottoms from the distillation of cleanout solvent (approximately two-thirds of total). Paint is prepared daily in the paint mix room, where colors are added, and then taken to the cab paint booths for use. Unused spray paint is returned to the paint mix room and placed into drums to which 5 gal of ethyl alcohol was previously added. The ethyl alcohol neutralizes the paint catalyst. The solution is constantly agitated to prevent solidification of the paint solids. This material is shipped offsite to a fuel blending operation at a cost of $20 per drum. Previously, the unused spray paint was allowed to harden in the drum. This material was incinerated at a cost of $450 per drum. This change in disposal practice is reflected in the annual costs of disposal.

The still bottoms are generated from the operation of a recovery still. Wash solvent (Solvent 2506) is used to clean out the paint guns and lines when switching from one paint color to another. The dirty wash solvent is pumped to an onsite distillation unit to be distilled for reuse. Generally, 350 to 400 gal of dirty solvent is distilled each day. This generates still bottoms at a rate of 1 to 2 drums per day. The volume of waste solvent generated has decreased during the past several years. This is due primarily to a change in the cleanout process. Previously the paint line was placed into the solvent container and pumped through at 14 oz/min. With the new system, solvent is introduced at 60 psi and air is injected. The air improves the efficiency of the cleanout process and reduces the volume of solvent required. From 1987 to 1989 the cost of disposal of paint wastes and still bottoms has decreased 82% (Table 2), although the quantity of these wastes during that time period actually increased.

The detackified paint waste is the residual paint overspray which accumulates in the water reservoirs of the downdraft water booths. The paint booths are equipped with water curtains to collect paint overspray. Hydrocyclones are used at several of the booths to remove a portion of the paint solids each day. Each hydrocyclone generates 1/4 to 1 drum of detackified paint waste (20% solids) each day. A portion of the paint booth water (3,000 gal) is discharged daily to the onsite pretreatment system. Approximately every 4 to 6 weeks the detackified paint that has accumulated in the pits of each paint booth is pumped to a tank truck. These cleanouts generate a relatively wet (10% solids) paint sludge.

The water in the paint booth reservoirs is treated chemically to cause the detackification of the paint and to improve the operation of the system. The chemical treatment includes: 1) pH control (9.0 to 9.5), 2) addition of a cationic polymer and aluminum chloride to detackify the paint, 3) a foam controlling agent containing mineral oil to prevent foam from reaching electrical connections at the system pumps, and 4) a biocide to prevent the growth of bacteria which cause odors.

Phosphating of Miscellaneous Parts (E-Coat) Wastes

The E-Coat process generates wastes in the form of spent process solutions, contaminated rinse waters and tank bottoms. Figure 5 illustrates the wastestreams generated and their disposal frequency for the E-Coat process.

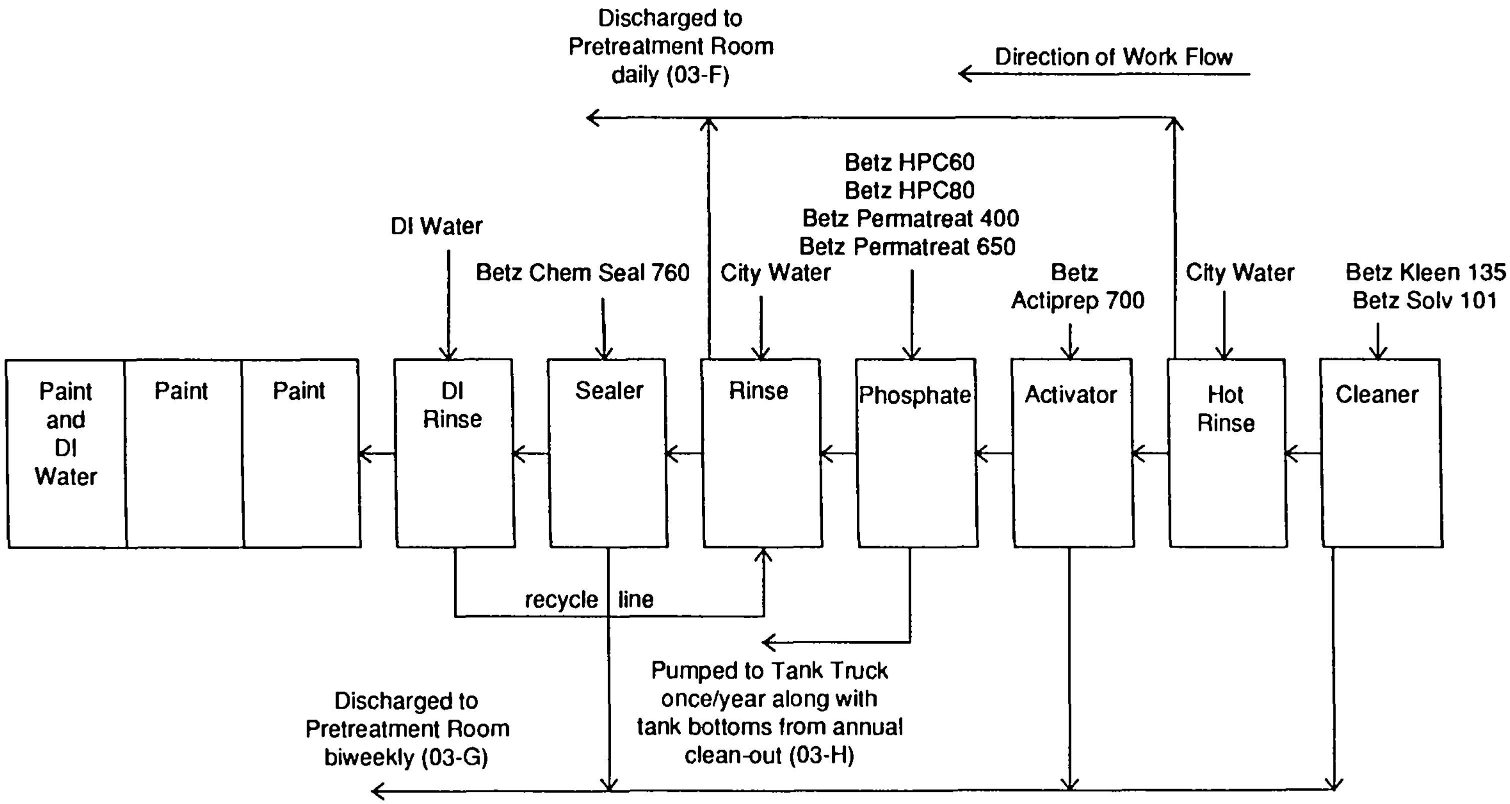

Figure 5. Wastestream Diagram of Phosphating (E-Coat) Operation

Contaminated rinse waters from tanks 2, 5, and 7 are discharged continuously during use to the pretreatment unit. Spent process solutions (Cleaner, Activator and Sealer) are drained and discharged to pretreatment every two weeks. Annually, all of the tanks in the E-Coat line are cleaned. This is done by pumping the tanks to temporary storage and removing the tank bottoms to a tank truck. The phosphate bath is hauled away with the tank bottoms during the annual cleaning.

Pretreatment sludge is generated by operation of the wastewater treatment system which treats wastewater from the paint booths and the phosphating/E-coat line. The system is a ferric chloride/caustic soda flocculation/precipitation process. Sludge from the clarification step is dewatered on a filter press to approximately 35% solids. The sludge (F019 RCRA waste) is sent to a hazardous waste landfill for disposal in bulk shipments. The treatment system generates approximately 10 to 12 tons of sludge every 90 days.

WASTE MINIMIZATION

The processes selected for this assessment, along with their wastestreams are summarized in Table 4. Current waste minimization techniques and waste disposal practices have enabled them to decrease both the volume of wastes and costs of waste disposal (Table 2) for their facility. The present methods of waste management used are presented in this section.

The quantities of wastes generated in 1989 for the spray painting, degreasing and phosphating operations are listed in Table 5 along with their associated disposal costs. Where the facility was unable to supply specific numbers, quantities were estimated on the basis of waste generation data collected during this assessment. In general, this facility sends smaller quantities of hazardous waste off-site than many other facilities with similar production levels. The waste disposal cost per truck produced in 1989 was approximately $7.03 which is a significant reduction from the cost of $31.05 per truck in 1987.

This facility has made major strides in waste minimization over the past two years. These efforts have focused on the following areas:

- Changes in paint formulation
- Changes in spray painting equipment
- Implementing operator controls and training
- Changing painting system cleanup procedures and equipment
- Adding dewatering units to spray paint booths
- Improving paint booth reservoir chemistry for detackifying overspray
- Reducing waste paint generation by minimizing the volumes mixed.

The next section of this report will focus on ways that waste generation can be further reduced.

TABLE 5. WASTES GENERATED IN 1989 FROM SPRAY PAINTING, DEGREASING AND PHOSPHATING PROCESSES

Wastestream	Stream Code	Annual Generation	Unit Cost for Disposal	Disposal Cost*
Waste Paint - Liquid (includes still bottoms from distillation unit)	01-A	213,142 lb	$.027/lb	$5,821
Waste Paint - Solid	01-B	11,218 lb	$.778	$8,731
Detackified Paint	01-C	523,000 lb	$.032/lb	$16,647
Paint Booth Water	01-D	780,000 gal	$2.20/1,000 gal[†]	$1,716
Degreasing Solvent	02-E	20,210 lb	$0.53/lb	$10,731
Rinse Waters	03-F	510,000 gal	$2.20/1,000 gal[†]	$1,122
Spent Process Solutions (Cleaner, Activator and Sealer)	03-G	43,680 gal	$2.20/1,000 gal[†]	$96
Phosphate Bath and Tank Bottoms	03-H	2,780 gal	$.24/gal	$667
Total Disposal Cost for Selected Wastes				$45,531

* Disposal costs include, where applicable, the onsite chemical treatment costs, transportation costs, and offsite treatment/disposal costs.

[†] These wastewaters are sent to the pretreatment system and then discharged to the POTW. The pretreatment process also generates a sludge from the treatment of these waters that is sent to a hazardous waste landfill.

SECTION 3

SUMMARY OF ASSESSMENT PHASE

The assessment phase of the waste minimization procedure includes data collection, selection of target areas, data review, and options generation and screening. The applicable worksheets are 4 through 13 (Appendix B). Table 6 lists the 8 wastestreams that were included in this assessment. The volume, characteristics, raw material costs and applicable waste minimization options are shown for each wastestream. The waste minimization options were developed jointly by the assessment team.

The WM screening process consists of a relative comparison of WM options using standard criteria presented in the WM Assessment Manual. This screening exercise is presented on Worksheet 13 and the results are summarized on Table 7. The criteria include various measures of waste minimization impacts relating to safety, cost, ease of implementation, and other relevant factors. Scores for individual WM options are determined by multiplying a weight factor, W, (1 to 10) for each criteria by a score (1 to 10) or measure (termed R-value) for how well each WM option satisfies each criteria (Score = RxW). Then, the scores for each WM option are summed over all criteria to produce a single score for each WM option. As indicated in Table 7, the scores for the identified options range from 348 to 487.

The weighted values (W) for each criteria were based on the goals of the waste minimization program. The measures for each option (R-value) were estimated by the assessment team. Where possible, these estimates were quantified (e.g., costs) and converted to R-values. For other measures, which could not be quantified, the R-values were estimated by the assessment team members through data review and discussion.

The result of the assessment phase was the selection of seven waste minimization options for further evaluation in the feasibility analysis phase (Section 4).

This section contains general descriptions of waste minimization technologies that are applicable to most truck assembly facilities. It also contains a description of the specific waste minimization options that were identified and evaluated during the assessment phase.

WASTE MINIMIZATION OPTIONS

The option generation step of the project (Worksheet 11) identified seven options that were considered to be potentially applicable. Options 1 and 6 relate to the use of water conservation measures with respect to paint booth water and rinse waters. Options 2 through 4 involve the reduction of waste paint generation using specialized equipment and monitoring procedures. Option 5 involves the reduction of waste solvent by avoiding contamination of fresh solvent. Option 7 involves the recycling of process solutions. Each of the seven options is briefly described in this section.

TABLE 6. SUMMARY OF WASTE MINIMIZATION ASSESSMENT PHASE

Process/Wastestream Name/ID	Annual Waste Quantity	Value of Input Materials, $/yr.	WM Options
Spray Painting/Waste Paint - Liquid/01-A	213,142 lb	$929,360	2, 3,4
Spray Painting/Waste Paint - Solid/01-B	12,280 lb	$58,897	2, 3, 4
Spray Painting/Detackified Paint/01-C	523,100 lb	$125,444	1, 2
Spray Painting/Paint Booth Water/01-D	780,000 gal	$939	1, 2
Degreasing/Degreasing Solvent/02-E	20,210 lb	$12,116	5
Phosphating/Rinse Waters/03-F	510,000 gal	$614	6
Spent Process Solutions (Cleaner, Activator and Sealer)/03-G	43,680 gal	$6383	7
Phosphating/Phosphate Bath and Tank Bottoms/03-H	2,780 gal	$2,333	--

TABLE 7. SUMMARY OF WASTE MINIMIZATION OPTIONS

Waste Minimization Option	Waste Option	Applicable Wastestreams	WM Option Screening Score
Belt Filter	1	01-C, 01-D	348
Transfer Efficiency	2	01-C, 01-D	423
Procedural/Small Equipment Changes	3	01-A, 01-B	377
Reduce Paint Mix Volumes	4	01-A, 01-B	462
Maintain Solvent Segregation	5	02-E	487
Ion Exchange/Recycle of Rinse Waters	6	03-F	387
E-Coat Line - Bath Maintenance	7	03-G	373

Option 1 - Paint Solids Dewatering and Water Recycle

Detackified paint that has built-up in the paint booth reservoirs over a period of four to six weeks is pumped directly to a tank truck and hauled to a disposal site. The detackified paint has a high water content (up to 95%) which increases disposal costs that are based solely on volume. The dewatering of this detackified paint can significantly reduce the cost of disposal by reducing the volume of waste sent to disposal. Further, recycling of the booth water will reduce water usage and extend the period between required draining and cleaning of the booths, thus reducing production downtime and booth chemical usage.

The dewatering process can be accomplished with the use of a belt filter (see Appendix C for cost information). The belt filter is an automatic gravity filtration system that typically uses a disposable fabric as the filter media. The detackified paint will be pumped from the paint booth to the belt filter. The fabric media filters out the paint solids and other debris while the water passing through is recycled to the paint booth reservoir. The detackified paint is rolled off of the filter into a drum to await disposal.

Belt filters are available with different filter areas to obtain the desired flow rate. Fabric media is chosen according to the type of filtration desired.

Option 2 - Improve Transfer Efficiency

Transfer efficiency refers to the percentage of paint that leaves the paint gun and is actually deposited on the part's surface. A higher transfer efficiency means more paint is reaching the finished part. Two types of spray painting equipment that have high transfer efficiencies are high volume-low pressure (HVLP) (up to 90% efficiency) and electrostatic (up to 75% efficiency). The facility currently uses HVLP in their chassis paint booth (11 psi) and have obtained a transfer efficiency of approximately 50%. The cab painting equipment is air assisted airless. Previously, it was operated at 60 psi. By modifying the air caps, the facility has reduced operating pressure to 40 psi and have achieved improved transfer efficiency. It is unclear whether further increases in efficiency are technically feasible for cab painting. It may, however, be possible to further increase chassis painting efficiency by installing electrostatic spray painting. The facility has done some preliminary tests at the plant with electrostatic spray painting and achieved positive results. This change was therefore evaluated under this option. An improved transfer efficiency would decrease raw material costs, decrease the volume of paint solids resulting from overspray, decrease paint booth maintenance, and reduce VOC emissions.

Option 3 - Procedural and Small-Equipment Changes

The facility is currently investigating a variety of procedural and small-equipment changes which will improve their waste minimization efforts for the spray painting operations. The following is a discussion of each change.

Shipping Unused Paint With the Finished Truck--

Small volumes (< 1 gal) of unused paint are generated from the cab painting operation. Many of the cabs are custom painted and the unused paint is usually not immediately reusable and therefore is discarded. This change involves packaging the unused paint in a suitable container and shipping it with the truck for later use by the customer for needed touch-ups. Before implementation, regulatory constraints governing this option will be evaluated.

Adjusting the Production Schedules to Reduce Color Changes--

After painting each truck cab, the painting system must be cleaned out unless the same color is used for the subsequent truck. At present, some consideration is given to the painting sequence when the overall production schedule is developed. However, some improvement is still possible. This change involves giving greater consideration to the painting sequence. This change is considered valid since the waste generation rate from painting is so closely tied to the number of clean-outs. Further, this is the only process whose waste generation rate is related to the production sequence.

Installation of Control and Monitoring Devices and Alarms on Painting Systems--

The transfer efficiencies of the spray painting operations are operator dependent and are partly related to the air pressures used. High pressures generally reduce the transfer efficiency and therefore increase waste generation. Operators of spray painting equipment often use higher than necessary air pressures because the higher pressures reduce painting time. This change involves the use of: 1) controls on the painting system to reduce the maximum air pressure level, 2) digital displays of the air pressure being used which are visible by the foremen, and 3) high pressure alarms. These equipment changes will provide greater control over the painting operation.

Another device that could be used is a microprocessor control for paint flow. These devices closely control the flow rate of paint and can be expected to increase transfer efficiency.

One alternative to these changes is the use of robot painting systems. Such systems are used extensively by automobile manufacturers. However, their application is questionable because of the lower production rate and the wide range of cab designs. Also robot systems are relatively expensive and their use cannot be economically justified by the savings from potential waste generation.

Painting Details Over Background Colors--

Many of the trucks produced are custom painted. The painting designs often include details such as stripes. Currently, when stripes are ordered, the cab is entirely painted with the color of the stripe. The stripe is then masked and the cab is repainted with the general or "background" color. This procedure is used because it requires less masking, which is labor intensive.

Changing this procedure by reversing the sequence would significantly reduce the volume of paint sprayed and therefore the waste produced by overspray. The higher masking costs may be justified when considering both the raw material costs for paint and the disposal costs for related wastes.

Option 4 - Reduce Paint Mix Volume

Paints for cab painting are custom mixed using an automated device in the paint mix room and given to the painters prior to the painting of each cab. The volume of paint mixed is recorded in a computer data base by the operator in the paint mix room. The volume of paint mixed depends on: 1) the truck models which vary in painted area, and 2) the type of paint, since coverage varies between paints. After painting is completed, the painters return the unused paint to the mix room where it is discharged into drums. The unused volume is recorded in the data base. A review of the data base indicates that the average unused portion of paint can be reduced.

Option 4 involves more extensive use of the painting data base to reduce paint mix volumes and resultant waste paint volumes. This can be accomplished by using the computer software to generate statistical analyses of paint mix and waste volumes for different truck models and paint types.

Implementation of this option is expected to reduce raw material costs (paint) and waste disposal costs (unused paint).

Option 5 - Minimize Contamination of Degreasing Solvent

This option involves a minor equipment and a procedural change to prevent the contamination of solvent during the wiping process used to degrease frame rails (chassis). Currently, operators use solvent soaked rags which are rinsed and stored in the solvent container (bucket). When the solvent in the bucket becomes overly contaminated with oil, grease, and dirt, it is discarded into a drum to await disposal.

To reduce the volume of solvent discarded, the solvent bucket should be eliminated. The bucket should be replaced with a container that delivers a volume of solvent by hand pumping and has a secure lid to prevent the operators from rinsing rags in the fresh solvent. Once used, the rags should be wrung-out over a waste solvent container and fresh solvent would then be pumped onto the rag.

This option may require that the rags are changed more frequently, because the rinsing step currently used would no longer be available. These rags are currently recycled through an industrial laundry, and therefore additional wastes are not expected from this practice.

Option 6 - Ion Exchange with Recycle of Rinse Waters

The zinc phosphate/E-Coat line consists of several processing and rinsing steps. There are three rinse tanks: one hot rinse, one ambient temperature rinse, and one distilled water (DI water) rinse. The rinse tanks are fed on a continuous basis and discharged to a sewer line that conveys the wastewater to the pretreatment system. At the pretreatment system, the wastewater is combined with paint booth water and is chemically treated. The resultant sludge is considered a listed hazardous waste (FO19 - waste water treatment sludge from chemical conversion coating) by the State regulatory agency. Spent chemicals from the phosphate line are also discharged to the pretreatment system, with the exception of the phosphate solution which is hauled to disposal.

This option involves the use of an ion exchange (anion and cation columns) recycle system. The rinse waters discharged to the sewer would be treated by the system and recycled to the phosphating line on a continuous basis.

The system would reduce water use by recycling. The system may also reduce the volume of sludge generated by the pretreatment system. The pretreatment process currently includes the use of ferric chloride in the flocculation/precipitation system. Ferric chloride is occasionally used in systems where metal complexes are present as a result of phosphating chemicals. It is also applicable to oily wastes such as those discharged from paint booth reservoirs. Use of the ferric chloride results in high sludge volumes since the iron is precipitated as hydroxide. The ion exchange system may reduce the use of ferric chloride by 1) breaking the phosphate complex and 2) by reducing the hydraulic loading of the pretreatment system. The heavy metals, such as zinc, will be retained on the cation column and the anions such as phosphate, will be retained on the anion column. The regenerant from the cation column will contain regulated metals and would require pretreatment before discharge. The regenerant from the anion column may not contain any regulated pollutants and it may be possible to discharge it following simple neutralization, thus eliminating it from the treatment process.

Prior to implementing this option, the facility should conduct treatability tests to select the optimal ion exchange resins and to determine its impact on the ferric chloride requirements.

Option 7 - E-Coat Line Bath Maintenance

The process solutions contained in tanks 1 (cleaner), 3 (surface activator), and 6 (non-chromium sealer) are discarded approximately every two weeks and reformulated with fresh chemicals. The discarded solutions are drained to the treatment system. Concentrated wastewaters such as these can be expected to require a significant volume of chemical reagents for treatment and result in high sludge volumes. This option involves the use of filtration devices to remove undissolved contaminants and maintain the solution in working condition for an extended time period.

SECTION 4

FEASIBILITY ANALYSIS RESULTS

SUMMARY OF FEASIBILITY ANALYSIS PHASE

The purpose of the feasibility analysis phase is to prepare a technical and economic evaluation of the WM options and to select options for implementation.

The technical feasibility evaluation initially determines the nature of the WM options, either equipment-related, personnel/procedure-related, or materials-related. For each of the three types of WM options, specific information and data are required. For equipment-related options, the information requirements relate to the state of the technology, availability of equipment, performance specifications, testing, space and utilities, production effects, and training. For personnel/ procedure-related options the required information relates to training and operating instruction changes. For materials-related options, the required information relates to production impacts, storage and handling, training and testing.

The WM options evaluated during this project include five equipment-related options, one personnel/procedure-related option, and one materials-related option. The technical evaluation for each option is detailed on Worksheet 14.

The economic feasibility evaluation includes a cost analysis of both capital and operating costs. Capital costs include equipment, materials, utility connections, site preparation, installation, engineering, start-up, and training.

The operating costs include increases and decreases (cost savings) of utilities, disposal fees, raw materials, labor, and revenues from recovered products. Insurance and liabilities costs were not included in the operating cost calculation, since these costs were undetermined during the project. Also, onsite handling costs which are usually very significant were not included. Therefore, the projected savings that were calculated during this project, understate the actual potential savings.

RECOMMENDATIONS

The technical and economic results of the feasibility analysis phase are summarized in Table 8. This table indicates for each option, the total capital investment, the net operating cost savings and the payback period (total capital investment/net operating cost savings).

To further evaluate the relative benefits of each option, the options have been ranked (1 for the best to 7 for the worst) with respect to the net operating cost savings and the payback period. These rankings were then summed for each option and compared among all options and a final ranking was determined (1 for the best to 7 for the worst). These comparisons are shown in the final column in Table 8. Using these two criteria heavily weights the evaluation in terms of annual cost savings since both criteria contain annual costs factors. Other techniques for comparing options may also be valid. Worksheet 17 (Appendix C) is an alternative method, which calculates profitability based on cash flow.

TABLE 8. SUMMARY OF WASTE MINIMIZATION FEASIBILITY ANALYSIS PHASE

Process & Wastestream	Waste Minimization Option	Nature of WM Option	Capital Invest-ment ($)	Net Op. Cost Savings ($/yr)	Payback Period (yr)	Rank Low to High (1-6)
Spray painting:						
Waste paint (01-A, 01-B)	2	Improve transfer efficiency	27,456	152,698	0.2	2
	3	Procedural/small-equip.	Unk.*	Unk.*	Unk.*	NA
	4	Reduce paint mix volumes	2,725	26,315	0.1	1
Detackified paint (01-C)	1	Paint solids dewatering	11,151	14,998	0.7	4
	2	Improve transfer efficiency				---
Paint booth water (01-D)	1	Paint solids dewatering				---
	2	Improve transfer efficiency	---	---	---	---
Degreasing of frame rails (Chassis):						
Degreasing solvent (02E)	5	Minimize solvent contamination	466	17,219	<0.1	2
Phosphating of misc. parts (E-Coat)						
Rinse waters (03F)	6	Ion exchange recycle	45,500	19,311	2.4	4
Spent process solutions (cleaner, activator and sealer)(03-G)	7	Bath maintenance	13,200	3,332	4.0	6

* The investment and projected savings for the procedural/small-equipment changes (Option 3) were not determined during the feasibility analysis phase. However, the majority of minimization techniques which make up this option are expected to be implemented by the facility.

The relative comparison used in this study indicates that the best options appear to be: Option 4–reducing paint mix volumes through closer control, Option 5–minimizing solvent contamination by using a different working container and procedures and Option 2–improving transfer efficiency by installing electrostatic painting in the chassis booth. Two options ranked with moderately good scores: Option 1–dewatering paint solids and recycling the booth waters and chemicals and Option 6–using ion exchange to recycle the phosphate/E-coat rinse waters. Option 7–bath maintenance on the phosphate/E-coat line ranked last; however, it is still within a reasonable range. Option 3–procedural and small equipment changes for painting was not evaluated during the feasibility analysis phase because the costs and savings could not be projected at this time. The Option 3 waste minimization techniques however appear to be technically and economically viable.

Some testing is needed before implementation of several of the options. For Option 1, testing should focus on determining if recycle can significantly reduce booth chemical use. A conservative assumption was made during the analysis that a 10% reduction is possible. For Option 2, the facility should contact electrostatic paint equipment suppliers and request an on-site demonstration. For Option 6, bench scale testing and possibly pilot scale testing is needed to determine the most suitable ion exchange resins. Testing is also needed to evaluate the impact of recycle on the current pretreatment process since a significant portion of the savings projected for this option relate to a reduction of treatment reagent use and sludge generation. Bath maintenance (Option 7) can be evaluated using simple cartridge filtration devices to remove solids from one of the process tanks (e.g., tank 1).

Appendix A

Planning and Organizational Phase
Worksheet 2

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER.	CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 04/16/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 1 OF 1

WORKSHEET 2

PROGRAM ORGANIZATION

EPA

FUNCTION	NAME	LOCATION	TELEPHONE
Program Manager	Mary Ann Curran	EPA/ORD, Cincinnati, OH	(513) 569-7837
Site Coordinator			
Assessment Team	George Cushnie	SAIC, McLean, VA	(703) 734-4397

Appendix B

Assessment Phase
Worksheets 4 to 13

FIRM		WASTE MINIMIZATION ASSESSMENT	PREPARED BY	
SAIC			S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
DATE-INITIAL 01/03/90	DATE-REVISED 04/17/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 1 OF 3

WORKSHEET 4

SITE DESCRIPTION

EPA

Firm:	
Plant: Assembly Plant	
Department: Production	
Area: Paint	
Street Address:	
City:	
State/Zip	
Telephone:	
Major Products: Trucks	
SIC Codes: 3713	
EPA Generator Number:	
Major Unit or:	
Product or:	
Operations: Spray painting of truck cabs and frame rails	

Personnel:	Cab Painting	Frame Rail (Chassis) Painting
days/week	5	5

Facilities/Equipment Age:
Spray painting booths: 16 years
hydrocyclones: 1 year (hydrocyclones are in use on two of the paint booths)

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE .	PROC. UNIT/OPER. E-Coat		CHECKED BY G. Cushnie	
DATE-INITIAL 01/03/90	DATE-REVISED 04/17/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 2 OF 3

WORKSHEET 4

SITE DESCRIPTION

EPA

Firm:
Plant: Assembly Plant
Department: Fabrication
Area: Fabrication
Street Address:
City:
State/Zip
Telephone:
Major Products: Trucks -
SIC Codes: 3713
EPA Generator Number:
Major Unit or:
Product or:
Operations: Automated phosphating process and electro-coat for small and medium sized truck parts
Personnel:
days/week: 5
Facilities/Equipment Age: E - coat process tanks: 16 years

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Degreasing of Frame Rails (Chassis)	CHECKED BY G. Cushnie	
DATE-INITIAL 01/03/90 / DATE-REVISED 04/17/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 3 OF 3

WORKSHEET 4

SITE DESCRIPTION

EPA

Firm:
Plant: Assembly Plant
Department: Production
Area: Paint
Street Address:
City:
State/Zip
Telephone:
Major Products: Trucks
SIC Codes: 3713
EPA Generator Number:
Major Unit or:
Product or:
Operations: Degreasing of frame rails (chasis)
Personnel:
days/week 5
Facilities/Equipment Age: Degreasing booth: 16 years

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE			CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 03/09/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 1 OF 8

WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Detacifier	Stream No. Detacifier	Stream No. Foam Control
1 Name/ID	Betz Detac 821	Betz Detac 942	Betz Foam Trol 2544
2 Source/Supplier	Betz Metchem	Betz Metchem	Betz Metchem
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6 Component/Attribute of Concern	Potassium hydroxide/sodium silicate	Aluminum Chlorhydroxide	Mineral Oil
7 Annual Consumption Rate	N/A	N/A	N/A
8 Overall	19,425 *	47,160 *	7,600 *
9 Component(s) of Concern	N/A	N/A	N/A
10	N/A	N/A	N/A
11 Purchase Price, $ per ______	$.46/*	$1.32/*	$1.14/*
12 Overall Annual Cost	$8,936.00	$62,251.00	$8,664.00
13	N/A	N/A	N/A
14 Delivery Mode (2)	Shuttle Tank	Shuttle Tank	Truck
15 Ship. Container Size & Type (3)	Tank	Tank	55 gal drum
16 Storage Mode (4)	Outdoor	Outdoor	Warehous
17 Transfer Mode (5)	Pump	Pump	Ton-loader
18 Empty Container Disp./Mangt. (6)	Return to supplier	Return to supplier	Sold for reuse
19 Shelf Life	6 months	6 months	6 months
20 Supplier Would :	N/A	N/A	N/A
21 Accecpt Expired Material (Y/N)	Y	Y	Y
22 Accept Shipping Containers (Y/N)	Y	Y	N
23 Revise Expiration Date (Y/N)	Y	Y	Y
24 Acceptable Substitute(s), if any	N/A	N/A	N/A
25 Alternate Supplier(s)	N/A	N/A	N/A

1. Stream numbers should correspond to those used on process flow diagrams.
2. e.g., pipeline, tank car, 100bbl. 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.

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE			CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 04/23/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 2 OF 8

WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Bacterial Control	Stream No. Paint	Stream No. Wash Solvent
1 Name/ID	Betz Slimicide C-31	Imron polyurethane Enamel	Solvent 2506
2 Source/Supplier	Betz Metchem	E.I. du Pont de Nemours & Co (Inc.)	Chemcentral
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	443	N/A	N/A
6 Component/Attribute of Concern	Dodecylguanidine Hydrochloride/Methylene	Methyl Ethyl Ketone	Toluene/Acetone/Normal Butyl Acetate/Isopropyl alcohol
7 Annual Consumption Rate	N/A	N/A	N/A
8 Overall	160 *	42,000 gal.	73,709 gal.
9 Component(s) of Concern	N/A	N/A	N/A
10	N/A	N/A	N/A
11 Purchase Price, $ per ______	$6.60/*	$40/gal	$1.61/gal
12 Overall Annual Cost	$1,056.00	$1,680,000	$36,254
13	N/A	N/A	N/A
14 Delivery Mode (2)	Truck	Truck	Tank Truck
15 Ship. Container Size & Type (3)	5 gal. pail	55 gal. drums, 5 gal. pails, 1 gal. cans	N/A
16 Storage Mode (4)	Warehouse	Warehouse	Above-ground storage tank
17 Transfer Mode (5)	Hand carried	By hand or ton-loader	Pump
18 Empty Container Disp./Mangt. (6)	Crush and landfill	Sold for reuse or crush & Landfill	Recycle
19 Shelf Life	6 months	6 months	N/A
20 Supplier Would:	N/A	N/A	N/A
21 Accept Expired Material (Y/N)	Y	N/A	N/A
22 Accept Shipping Containers (Y/N)	N	N	N/A
23 Revise Expiration Date (Y/N)	Y	N/A	N/A
24 Acceptable Substitute(s), if any	N/A	N/A	N/A
25 Alternate Supplier(s)	N/A	N/A	N/A

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

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 04/23/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 3 OF 8

WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Water	Stream No.	Stream No.
1 Name/ID	City water		
2 Source/Supplier			
3	N/A		
4	N/A		
5	N/A		
6 Component/Attribute of Concern	pH 10		
7 Annual Consumption Rate	120,000 gal./month		
8 Overall	1,440,000 gal.		
9 Component(s) of Concern	N/A		
10	N/A		
11 Purchase Price, $ per ______	$.90/100 ft3		
12 Overall Annual Cost	$1,730.00		
13	N/A		
14 Delivery Mode (2)	Pipeline		
15 Ship. Container Size & Type (3)	N/A		
16 Storage Mode (4)	N/A		
17 Transfer Mode (5)	Pipeline		
18 Empty Container Disp./Mangt. (6)	N/A		
19 Shelf Life	N/A		
20 Supplier Would:	N/A		
21 Accecpt Expired Material (Y/N)	N/A		
22 Accept Shipping Containers (Y/N)	N/A		
23 Revise Expiration Date (Y/N)	N/A		
24 Acceptable Substitute(s), if any	N/A		
25 Alternate Supplier(s)	N/A		

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

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE			CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 03/09/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1	PAGE 4 OF 8

WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Cleaner	Stream No. Cleaner	Stream No. Precipitate
1 Name/ID	Betz kleen 128	Betz solv. - 101	Betz HPC 80
2 Source/Supplier	Betz Metchem	Betz Metchem	Betz Metchem
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6 Component/Attribute of Concern	Sodium carbonate tetrasodium pyrophospate	Alkoxylated fatty alcohol/non-ionic	Ammonium fluoride
7 Annual Consumption Rate	N/A	N/A	N/A
8 Overall	1,340 #	920 #	490 #
9 Component(s) of Concern	N/A	N/A	N/A
10	N/A	N/A	N/A
11 Purchase Price, $ per ______	$1.19/#	$1.51/#	$2.64/#
12 Overall Annual Cost	$1,595.00	$1,389.00	$1,294.00
13	N/A	N/A	N/A
14 Delivery Mode (2)	Truck	Truck	Truck
15 Ship. Container Size & Type (3)	Fiber container	55 gal. drum	55 gal. drum
16 Storage Mode (4)	Indoor	Indoor	Indoor
17 Transfer Mode (5)	By hand	Pump	Pump
18 Empty Container Disp./Mangt. (6)	Crush and landfill	Sold for reuse	Sold for reuse
19 Shelf Life	6 months	6 months	6 months
20 Supplier Would :	N/A	N/A	N/A
21 Accecpt Expired Material (Y/N)	Y	Y	Y
22 Accept Shipping Containers (Y/N)	N	N	N
23 Revise Expiration Date (Y/N)	Y	Y	Y
24 Acceptable Substitute(s), if any	N/A	N/A	N/A
25 Alternate Supplier(s)	N/A	N/A	N/A

1. Stream numbers should correspond to those used on process flow diagrams.
2. e.g., pipeline, tank car, 100bbl. 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 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Zinc phosphating	Stream No. pH adjustment	Stream No. Conversion coating
1 Name/ID	Betz permatreat 400	Betz HPC 60	Betz chemseal 760
2 Source/Supplier	Betz Metchem	Betz Metchem	Betz Metchem
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6 Component/Attribute of Concern	Phosphoric acid	Sodium hydroxide	Phosphoric acid/monoethanolamine
7 Annual Consumption Rate	N/A	N/A	N/A
8 Overall	625 #	0 #	1,440 #
9 Component(s) of Concern	N/A	N/A	N/A
10	N/A	N/A	N/A
11 Purchase Price, $ per ______	$1.12/#	$.60/#	$1.15/#
12 Overall Annual Cost	$700.00	$0.00	$1,656.00
13	N/A	N/A	N/A
14 Delivery Mode (2)	Truck	Truck	Truck
15 Ship. Container Size & Type (3)	55 gal. drum	55 gal drum	55 gal drum
16 Storage Mode (4)	Indoor	Indoor	Indoor
17 Transfer Mode (5)	Pump	Pump	Pump
18 Empty Container Disp./Mangt. (6)	Sold for reuse	Sold for reuse	Sold for reuse
19 Shelf Life	6 months	6 months	6 months
20 Supplier Would :	N/A	N/A	N/A
21 Accecpt Expired Material (Y/N)	Y	Y	Y
22 Accept Shipping Containers (Y/N)	N	N	N
23 Revise Expiration Date (Y/N)	Y	Y	Y
24 Acceptable Substitute(s), if any	N/A	N/A	N/A
25 Alternate Supplier(s)	N/A	N/A	N/A

1. Stream numbers should correspond to those used on process flow diagrams.
2. e.g., pipeline, tank car, 100bbl. 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.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
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WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Conversion coating	Stream No. pH adjustment	Stream No. Corrosion inhibitor
1 Name/ID	Betz Actiprep 700	Betz HPC 18	Betz Permatreat 650
2 Source/Supplier	Betz Metchem	Betz Metchem	Betz Metchem
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6 Component/Attribute of Concern	Disodium phosphate	Phosphoric Acid	Sodium Nitrite
7 Annual Consumption Rate	N/A	N/A	N/A
8 Overall	500 #	360 #	565 #
9 Component(s) of Concern	N/A	N/A	N/A
10	N/A	N/A	N/A
11 Purchase Price, $ per ________	$3.38/#	$1.13/#	$.60/#
12 Overall Annual Cost	$1,690.00	$407.00	$399.00
13	N/A	N/A	N/A
14 Delivery Mode (2)	Truck	Truck	Truck
15 Ship. Container Size & Type (3)	Fiber container	55 gal. drum	55 gal. drum
16 Storage Mode (4)	Indoor	Indoor	Indoor
17 Transfer Mode (5)	By hand	Pump	Pump
18 Empty Container Disp./Mangt. (6)	Crush and landfill	Sold for reuse	Sold for reuse
19 Shelf Life	6 months	6 months	6 months
20 Supplier Would :	N/A	N/A	N/A
21 Accecpt Expired Material (Y/N)	Y	Y	Y
22 Accept Shipping Containers (Y/N)	N	N	N
23 Revise Expiration Date (Y/N)	Y	Y	Y
24 Acceptable Substitute(s), if any	N/A	N/A	N/A
25 Alternate Supplier(s)	N/A	N/A	N/A

1. Stream numbers should correspond to those used on process flow diagrams.
2. e.g., pipeline, tank car, 100bbl. 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 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Water	Stream No.	Stream No.
1 Name/ID	City Water		
2 Source/Supplier	Municipal Water Source		
3	N/A		
4	N/A		
5	N/A		
6 Component/Attribute of Concern	pH 10		
7 Annual Consumption Rate	200 gal/day		
8 Overall	510,000 gal		
9 Component(s) of Concern	N/A		
10	N/A		
11 Purchase Price, $ per ______	$.90/100ft(3)		
12 Overall Annual Cost	$614.00		
13	N/A		
14 Delivery Mode (2)	Pipeline		
15 Ship. Container Size & Type (3)	N/A		
16 Storage Mode (4)	N/A		
17 Transfer Mode (5)	Pipeline		
18 Empty Container Disp./Mangt. (6)	N/A		
19 Shelf Life	N/A		
20 Supplier Would:	N/A		
21 Accecpt Expired Material (Y/N)	N/A		
22 Accept Shipping Containers (Y/N)	N/A		
23 Revise Expiration Date (Y/N)	N/A		
24 Acceptable Substitute(s), if any	N/A		
25 Alternate Supplier(s)	N/A		

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

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WORKSHEET 7

INPUT MATERIALS SUMMARY

EPA

Attribute	Description (1)		
	Stream No. Degreasing solvent	Stream No.	Stream No.
1 Name/ID	K special blend		
2 Source/Supplier	Calvary Chemical Co.		
3	N/A		
4	N/A		
5	N/A		
6 Component/Attribute of Concern	1,1,1 trichloroethane methylene chloride		
7 Annual Consumption Rate	275 gal/week		
8 Overall	14,000 gal.		
9 Component(s) of Concern	N/A		
10	N/A		
11 Purchase Price, $ per gal.	$5.00/gal.		
12 Overall Annual Cost	$70,000		
13	N/A		
14 Delivery Mode (2)	Truck		
15 Ship. Container Size & Type (3)	55 gal. drum		
16 Storage Mode (4)	Hazardous waste storage area		
17 Transfer Mode (5)	Ton-loader		
18 Empty Container Disp./Mangt. (6)	Sold for reuse		
19 Shelf Life	N/A		
20 Supplier Would:	N/A		
21 Accecpt Expired Material (Y/N)	N/A		
22 Accept Shipping Containers (Y/N)	N		
23 Revise Expiration Date (Y/N)	N/A		
24 Acceptable Substitute(s), if any	N/A		
25 Alternate Supplier(s)	N/A		

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

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WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Waste Paint-Liquid Stream Number 01-A

   Process Unit/Operation Spray Painting

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☒ liquid ☐ solid ☐ mixed phase

   Density, lb/cu ft ________ Heating Value, Btu/lb ________

   Viscosity/Consistency ________

   pH ________ Flash Point ________ % Water ________

3. Waste Leaves Process as:

   ☐ air emission ☐ wastewater ☐ solid waste ☒ hazardous waste

4. Occurrence

   ☐ continuous ________

   ☒ discrete ________

   discharge triggered by ☐ chemical analysis ________

   ☒ other (describe) Leftover paint from painting operations

   Type: ☒ periodic ________ length of period: daily

   ☒ sporadic (irregular occurance)

   ☐ non-recurrent

5. Generation Rate

   Annual 213,142 * (estimated in [illegible]) per year

   Maximum ________ per ________

   Average ________ per ________

   Frequency ________ batches per ________

   Batch Size ________ Average ________ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Waste Paint-Liquid

6. Waste Origins/Sources

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☐ Yes ☒ No

Describe how the waste is generated.

Paint is prepared daily in the paint mix room and taken to the cab paint booths. Any leftover paint from the cab paint booths is returned to the paint mix room and placed in a drum for waste paint. The frame rail (chassis) paint booth has a bulk spray system for black paint which should produce no waste paint. However, when a chassis is painted any other color the paint is prepared in the paint mix room and any left over paint is put in a drum in the chassis paint booth. The paint is kept liquid with the addition of ethanol which neutralizes the catalyst in the paint.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION
(continued)

EPA

Waste Stream Waste Paint-Liquid

7. Management Method

Leaves site in:

- ☐ bulk
- ☐ roll off bins
- ☒ 55 gal drums
- ☐ other (describe)

Disposal Frequency Every 90 days

Applicable Regulations RCRA

Regulatory Classification Flammable waste UN1993
F003/F005

Managed

- ☐ onsite ☒ offsite
- ☐ commercial TSDF
- ☐ own TSDF
- ☒ other (describe) Cement Kiln Facility

Recycling

- ☒ direct use/re-use Fuel blending
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☒ No ☒ used by others

residue yield

residue disposal/
repository

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S Roman	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

Waste Stream Waste Paint-Liquid

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☐ precipitation
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☐ landfill
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☐ other (describe)

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$1250.00	per 5000 gal - this indcludes a transporation fee
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$1250.00	

Specify units, $/ gal

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Waste Paint-Solid Stream Number 01-B

   Process Unit/Operation Spray Painting

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☐ liquid ☒ solid ☐ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH ______ Flash Point ______ % Water ______

3. Waste Leaves Process as:

   ☐ air emission ☐ wastewater ☒ solid waste ☒ hazardous waste

4. Occurrence

   ☐ continuous ______

   ☒ discrete ______

   discharge triggered by ☐ chemical analysis ______

   ☒ other (describe) Emptying of Waste Paint - Liquid drums

   Type: ☒ periodic ______ length of period: 90 days

   ☒ sporadic (irregular occurance)

   ☐ non-recurrent

5. Generation Rate

   Annual 12,280 * (estimated in 1989) per year

   Maximum ______ per ______

   Average ______ per ______

   Frequency ______ batches per ______

   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Waste Paint-Solid

6. Waste Origins/Sources

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☐ Yes ☒ No

Describe how the waste is generated.

Waste paint from the cab paint booths and the chassis paint booth is stored in 55 gal. drums to await disposal. These drums are pumped into a tank truck. Any solified paint in the bottom of the drums is scrapped out and consolidated into another 55 gal. drum for disposal.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Waste Paint-Solid

7. Management Method

Leaves site in:

- ☐ bulk
- ☐ roll off bins
- ☒ 55 gal drums
- ☐ other (describe)

Disposal Frequency Every 90 days

Applicable Regulations RCRA

Regulatory Classification Flammable waste UN1993
F003/F005

Managed

- ☐ onsite ☒ offsite
- ☒ commercial TSDF
- ☐ own TSDF
- ☐ other (describe)

Recycling

- ☐ direct use/re-use
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by others

residue yield

residue disposal/
repository

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Waste Paint-Solid

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☒ incineration
- ☐ pH adjustment
- ☐ precipitation
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☐ landfill
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☐ other (describe)

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$50.00	per 55 gal. drum
5 Disposal Fee	$300.00	per 55 gal. drum
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$350.00	

Specify units, $/ drum

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET
9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Detackified Paint Stream Number 01-C

   Process Unit/Operation Spray Painting

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☐ liquid ☐ solid ☒ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH ______ Flash Point ______ % Water ______

3. Waste Leaves Process as:
   ☐ air emission ☒ wastewater ☐ solid waste ☐ hazardous waste

4. Occurrence
   ☐ continuous ______
   ☒ discrete ______

   discharge triggered by ☐ chemical analysis ______
   ☒ other (describe) As needed

   Type: ☒ periodic ______ length of period: 4 to 6 weeks
   ☐ sporadic (irregular occurance)
   ☐ non-recurrent

5. Generation Rate
   Annual 523,100* (estimated in [illegible]) per year
   Maximum ______ per ______
   Average ______ per ______
   Frequency ______ batches per ______
   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Detackified Paint

6. **Waste Origins/Sources**

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☐ Yes ☒ No

Describe how the waste is generated.

The cab paint booths and the chassis paint booth have a water curtain to collect paint overspray. Each booth has its own pit for the collection of the water, and detackification of the paint. A paint sludge builds up in the pits and is collected on an as is needed basis.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Detackified Paint

7. Management Method

Leaves site

- ☒ bulk
- ☐ roll off
- ☐ 55 gal drums
- ☐ other (describe)

Disposal Frequency Every 4 to 6 weeks

Applicable Regulations City & Federal for metals content, temperature pH and oil

Regulatory Classification None

Managed

- ☐ onsite ☒ offsite
- ☒ commercial TSDF
- ☐ own TSDF
- ☐ other (describe)

Recycling

- ☐ direct use/re-use
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by ......

residue yield

residue disposal/ repository

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Detacsified Paint

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☐ precipitation
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☐ landfill
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☐ other (describe)

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$0.24	per gallon includes transportation costs
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$0.24	

Specify units, $/ gallon

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
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WORKSHEET
9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Paint Booth Water Stream Number 01-D

   Process Unit/Operation Spray Painting

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☒ liquid ☐ solid ☐ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH ______ Flash Point ______ % ______

3. Waste Leaves Process as:

   ☐ air emission ☒ wastewater ☐ solid waste ☐ hazardous waste

4. Occurrence

   ☐ continuous ______

   ☒ discrete ______

   discharge triggered by ☐ chemical analysis ______

   ☒ other (describe) Operator discretion

   Type: ☒ periodic ______ length of period: Daily

   ☐ sporadic (irregular occurance)

   ☐ non-recurrent

5. Generation Rate

   Annual 780,000 gals. [illegible] per year

   Maximum ______ per ______

   Average ______ per ______

   Frequency ______ batches per ______

   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/90	DATE-REVISED 04/23/90	PROJ. NO. 1-832-03-942-02	SHEET 2 of 4	PAGE 1 OF 8

WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Paint Booth Water

6. **Waste Origins/Sources**

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☒ Yes ☐ No

Describe how the waste is generated.

The cab paint booths and the chassis paint booth each have a water curtain to collect paint overspray. The water becomes contaminated with the oversprayed paint and solvent.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE .		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION
(continued)

EPA

Waste Stream Paint Booth Water

7. Management Method

Leaves site in:

- ☐ bulk
- ☐ roll off bins
- ☐ 55 gal drums
- ☒ other (describe) Through sewer pipe

Disposal Frequency Daily

Applicable Regulations City & Federal regulations on metals, temperature, pH and oil

Regulatory Classification None

Managed
- ☒ onsite ☐ offsite
- ☐ commercial TSDF
- ☐ own TSDF
- ☐ other (describe)

Recycling
- ☐ direct use/re-use
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by others

residue yield

residue disposal/ repository

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G Cushnie	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Paint Booth Water

7. Management Method (continued)

Treatment
- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☒ precipitation Ferric chloride/caustic soda system
- ☐ solidification
- ☒ other (describe) Filter press

residue disposal/repository
- ☒ landfill The sludge is sent to a TSDF
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☒ other (describe) The wate water is discharged to a POTW via a Permit to Discharge

Costs as of Jan. 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$1.65	per 100ft(3) sewer charge
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$1.65	

Specify units, $/ ______

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Romon	
SITE		PROC. UNIT/OPER. Degreasing Solvent	CHECKED BY G. Cushnie	
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WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. **Waste Stream Name/ID:** Degreasing Solvent **Stream Number** 02-E

   Process Unit/Operation Degreasing of Frame Rails (Chassis)

2. **Waste Characteristics(attach additional sheets with composition data)**

   ☐ gas ☒ liquid ☐ solid ☐ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH ______ Flash Point ______ % ______

3. **Waste Leaves Process as:**

   ☐ air emission ☐ wastewater ☐ solid waste ☒ hazardous waste

4. **Occurrence**

   ☐ continuous ______

   ☒ discrete ______

   discharge triggered by ☐ chemical analysis ______

   ☒ other (describe) As needed

   Type: ☒ periodic ______ length of period: ______

   ☐ sporadic (irregular occurance)

   ☐ non-recurrent

5. **Generation Rate**

   Annual 20,210 * [illegible] per year

   Maximum ______ per ______

   Average ______ per ______

   Frequency ______ batches per ______

   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Degreasing Solvent	CHECKED BY G Cushnie	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Degreasing Solvent

6. Waste Origins/Sources

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☐ Yes ☒ No

Describe how the waste is generated.

The chassis is degreased in a booth just prior to entering the chassis paint booth. A chlorinated solvent is used because of the immediate drying action and VOCs. The solvent is both sprayed and wiped on to the chassis. The waste comes from the wiping process. Rags are dipped into buckets of solvent and used to wipe down the chassis. The solvent in the bucket becomes contaminated with the dirty rags that are dipped repeatedly into the bucket.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Romen	
SITE	PROC. UNIT/OPER. Degreasing Solvent	CHECKED BY G. Cushnie	
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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Degreasing Solvent

7. Management Method

Leaves site

- ☐ bulk
- ☐ roll off
- ☒ 55 gal drums
- ☐ other (describe)

Disposal Frequency Every 90 days

Applicable Regulations RCRA

Regulatory Classification F001/F002/D006/D007

Managed

- ☐ onsite ☒ offsite
- ☐ commercial TSDF
- ☐ own TSDF
- ☐ other (describe)

Recycling

- ☐ direct use/re-use
- ☐ energy recovery Fuel blending at Ecolotec - A division of Stout Environmental
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☒ No ☐ used by

residue yield

residue disposal/ repository

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Degreasing Solvent	CHECKED BY G. Cushnie	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Degreasing Solvent

7. Management Method (continued)

Treatment
- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☐ precipitation
- ☐ solidification
- ☐ other (describe)

residue disposal/repository
- ☐ landfill
- ☐ pond
- ☐ lagoon
- ☐ deep
- ☐ ocean
- ☐ other (describe)

Costs as of Jan. 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$31.50	for pick-up and transport from 1 to 10 drums
5 Disposal Fee	$450.00	per drum
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$481.50	

Specify units, $/ drum

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. E-Coat	CHECKED BY S. Cushnie	
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WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Rinse Waters Stream Number 03-F

   Process Unit/Operation E-Coat

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☒ liquid ☐ solid ☐ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH ______ Flash Point ______ % Water ______

3. Waste Leaves Process as:

   ☐ air emission ☒ wastewater ☐ solid waste ☐ hazardous waste

4. Occurrence

   ☐ continuous ______

   ☐ discrete ______

   discharge triggered by ☐ chemical analysis ______

   ☒ other (describe) Chemical build-up

   Type: ☒ periodic ______ length of period: Daily

   ☐ sporadic (irregular occurance)

   ☐ non-recurrent

5. Generation Rate

   Annual 510,000 gal. per year

   Maximum ______ per ______

   Average ______ per ______

   Frequency ______ batches per ______

   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION
(continued)

EPA

Waste Stream Rinse Waters

6. **Waste Origins/Sources**
Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☒ Yes ☐ No

Describe how the waste is generated.

The E-Coat process is a series of 10 dip tanks. Tanks 2,5 and 7 contain rinsewaters. Tank 7 is made up of DI water and is recycled to tank 5 which is made up of city water and DI water. Tank 2 contains only city water. Tanks 2 and 5 are continuous overflow rinses and are discharged to the plants waste treatment system.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Rinse Waters

7. Management Method

Leaves site

- ☐ bulk
- ☐ roll off
- ☐ 55 gal drums
- ☒ other (describe) Through sewer pipe

Disposal Frequency Daily

Applicable Regulations City and Federal regulations on metal content, temperature, pH , and oil

Regulatory Classification None

Managed

- ☒ onsite ☐ offsite
- ☐ commercial TSDF
- ☐ own TSDF
- ☒ other (describe) Pretreatment on-site

Recycling

- ☒ direct use/re-use Tank 7 is recycled to Tank 5
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by others

residue yield

residue disposal/ repository

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

Waste Stream Rinse Waters

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☒ precipitation Ferric Chloride/Caustic Soda system
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☒ landfill The sludge is sent to a hazardous waste landfil
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☒ other (describe) Wastewater is discharged to the POTW via a Permit to Discharge

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$1.65	per 100ft(3) of water discharged
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$1.65	

Specify units, $/

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. E-Coat	CHECKED BY G. Guthrie	
DATE-INITIAL 02/09/90 / DATE-REVISED 03/09/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 4	PAGE 1 OF 8

WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Process Tanks 1,3,6 Stream Number 03-G

   Process Unit/Operation E-Coat

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☒ liquid ☐ solid ☐ mixed phase

   Density, lb/cu ft ____ Heating Value, Btu/lb ____

   Viscosity/Consistency ____

   pH ____ Flash Point ____ % Water ____

3. Waste Leaves Process as:

   ☐ air emission ☒ wastewater ☐ solid waste ☐ hazardous waste

4. Occurrence

   ☐ continuous ____

   ☒ discrete ____

   discharge triggered by ☐ chemical analysis ____

   ☒ other (describe) Operator discretion

   Type: ☒ periodic ____ length of period: 2 weeks

   ☐ sporadic (irregular occurance)

   ☐ non-recurrent

5. Generation Rate

   Annual 43,680 gal per year

   Maximum ____ per ____

   Average ____ per ____

   Frequency ____ batches per ____

   Batch Size ____ Average ____ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION
(continued)

EPA

Waste Stream Process Tanks 1,3,6

6. **Waste Origins/Sources**
Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☒ Yes ☐ No

Describe how the waste is generated.

The solution in the process tanks 1,3, and 6 becomes contaminated with oil & dirt from parts being dipped in them. Dragout from intermediate rinses dilutes the solutions and they need to be replenished.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT		PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9c

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Process Tanks 1,3,6

7. Management Method

Leaves site in:

- ☐ bulk
- ☐ roll off bins
- ☐ 55 gal drums
- ☒ other (describe) Through sewer pipe

Disposal Frequency Biweekly

Applicable Regulations City and Federal regulations on metal content, temperature, pH, and oil

Regulatory Classification None

Managed

- ☒ onsite ☐ offsite
- ☐ commercial TSDF
- ☐ own TSDF
- ☒ other (describe) Pretreatment on-site

Recycling

- ☐ direct use/re-use
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by others

residue yield

residue disposal/ repository

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY S. Cushnie	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

Waste Stream Process Tanks 1,3,6

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☒ precipitation Ferric Chloride/Caustic Soda system
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☒ landfill The sludge is sent to a hazardous waste landfill
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☒ other (describe) Wastewater is discharged to the POTW via a Permit to Discharge

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$1.65	per 100ft(3) of water discharged
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$1.65	

Specify units, $/

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9a

INDIVIDUAL WASTE STREAM CHARACTERIZATION

EPA

1. Waste Stream Name/ID: Phosphate Bath & Tank Bottoms Stream Number 03-H
   Process Unit/Operation E-Coat

2. Waste Characteristics (attach additional sheets with composition data)

   ☐ gas ☐ liquid ☐ solid ☒ mixed phase

   Density, lb/cu ft ______ Heating Value, Btu/lb ______

   Viscosity/Consistency ______

   pH 2.0 Flash Point ______ % Water ______

3. Waste Leaves Process as:
   ☐ air emission ☐ wastewater ☐ solid waste ☒ hazardous waste

4. Occurrence
   ☐ continuous ______
   ☒ discrete ______

   discharge triggered by ☐ chemical analysis ______
   ☒ other (describe) Operator discretion

   Type: ☒ periodic ______ length of period: 1 year
   ☐ sporadic (irregular occurance)
   ☐ non-recurrent

5. Generation Rate
   Annual 2,780 gal. per year
   Maximum ______ per ______
   Average ______ per ______
   Frequency ______ batches per ______
   Batch Size ______ Average ______ Range

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. E-Coat	CHECKED BY G Cushn'e	
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WORKSHEET 9b

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

Waste Stream Phosphate Bath & Tank Bottoms

6. **Waste Origins/Sources**

Fill out this worksheet to identify the origin of the waste. If the waste is a mixture of waste streams, fill out a sheet for each of the individual waste streams.

Is the waste mixed with other wastes? ☐ Yes ☒ No

Describe how the waste is generated.

The quality of the phosphate bath is maintained throughout the year with the addition of chemicals. The entire bath is replaced every one to two years or as needed at the operators discretion. This waste is usually mixed with the sludge from the tank bottoms in the E-Coat System. All of the tanks in the E-Coat system are cleaned once per year.

Example: Formation and removal of an undersirable compound, removal of an unconverted input material, depletion of a key component (e.g., drag-out), equipment cleaning waste, obsolete input material, spoiled batch and production run, spill or leak cleanup, evaporative loss, breathing or venting losses, etc.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman
SITE	PROC. UNIT/OPER. E-Coat	CHECKED BY J. Cushnie
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WORKSHEET 9C

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

Waste Stream Phophate Bath & Tank Bottoms

7. Management Method

Leaves site in:

- ☐ bulk
- ☐ roll off bins
- ☐ 55 gal drums
- ☒ other (describe) tank truck

Disposal Frequency Once per year

Applicable Regulations RCRA

Regulatory Classification F019

Managed

- ☐ onsite ☒ offsite
- ☒ commercial TSDF Tricil Environmental
- ☐ own TSDF
- ☐ other (describe)

Recycling

- ☐ direct use/re-use
- ☐ energy recovery
- ☐ redistilled
- ☐ other (describe)

reclaimed material returned to site?

☐ Yes ☐ No ☐ used by others

residue yield

residue disposal/ repository

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. E-Coat	CHECKED BY G. Cushnie	
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WORKSHEET 9d

INDIVIDUAL WASTE STREAM CHARACTERIZATION

(continued)

EPA

Waste Stream Phosphate Bath & Tank Bottoms

7. Management Method (continued)

Treatment

- ☐ biological
- ☐ oxidation/reduction
- ☐ incineration
- ☐ pH adjustment
- ☐ precipitation
- ☐ solidification
- ☐ other (describe)

residue disposal/repository

- ☐ landfill
- ☐ pond
- ☐ lagoon
- ☐ deep well
- ☐ ocean
- ☐ other (describe)

Costs as of Jan 1990 (quarter and year)

Cost Element:	Unit Price	Reference/Source
1 Onsite Storage and Handling	$0.00	
2 Pretreatment	$0.00	
3 Container	$0.00	
4 Transportation Fee	$0.00	
5 Disposal Fee	$0.24	per gal includes transportation fee
6 Local Taxes	$0.00	
7 State Tax	$0.00	
8 Federal Tax	$0.00	
Total Disposal Cost	$0.24	

Specify units, $/ gal

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 10

WASTE STREAM SUMMARY

EPA

Attribute		Description (1)					
		Stream No. 01-A		Stream No. 01-B		Stream No. 01-C	
1 Waste Name/ID		Waste Paint-Liquid		Waste Paint - Solid		Detackified Paint	
2 Source/Origin		Spray Paint Booth		Spray Paint Booth		Spray Paint Booth	
3 Component/or Property of Concern		N/A		N/A		N/A	
4 Annual Generation Rate, units:		N/A		N/A		N/A	
5 Overall		213,142 *		11,218 *		523,100 *	
6 Component(s) of Concern		N/A		N/A		N/A	
7		N/A		N/A		N/A	
8 Cost of Disposal		N/A		N/A		N/A	
9 Unit Cost, $ per:		$1,250/5000 gal.		$350/55 gal.		$.24/gal.	
10 Overall (per year)		$5,821.00		$8,731.00		$16,647.00	
11		N/A		N/A		N/A	
12 Method of Management (2)		Off-site recycle		Off-site incineration		Commercial TSDF	
13							
Priority Rating Criteria (3)	Relative Wt. (W)	Rating (R)	RxW	Rating (R)	RxW	Rating (R)	RxW
Regulatory Compliance	10.0	9.0	90.0	9.0	90.0	7.0	70.0
Treatment/Disposal Cost	9.0	0.3	2.7	8.0	72.0	1.0	9.0
Potential Liability	10.0	9.0	90.0	8.0	80.0	7.0	70.0
Waste Quantity Generated	7.0	0.3	2.1	0.0	0.1	0.8	5.6
Waste Hazard	8.0	10.0	80.0	9.0	72.0	7.0	56.0
Safety Hazard	6.0	10.0	60.0	8.0	48.0	7.0	42.0
Minimization Potential	5.0	9.0	45.0	2.0	10.0	8.0	40.0
Potential to Remove Bottleneck	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potential Byproduct Recovery	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum of Priority Scores		Σ(RxW)	369.8	Σ(RxW)	372.1	Σ(RxW)	292.6
Priority Rank		2		2		4	

Notes:

1. Stream numbers should correspond to those used on process flow diagrams.
2. For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
3. Rate each stream in each category on a scale from 0 (none) to 10 (high).

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
DATE-INITIAL 02/09/09 / DATE-REVISED 03/09/90	PROJ. NO. 1-532-03-942-02	SHEET 1 OF 1	PAGE OF 4

WORKSHEET 10

WASTE STREAM SUMMARY

EPA

Attribute		Description (1)					
		Stream No. 01-D		Stream No.		Stream No.	
1 Waste Name/ID		Paint Booth Water					
2 Source/Origin		Spray Paint Booth					
3 Component/or Property of Concern		N/A					
4 Annual Generation Rate, units:		N/A					
5 Overall		780,100 gal.					
6 Component(s) of Concern		N/A					
7		N/A					
8 Cost of Disposal		N/A					
9 Unit Cost, $ per:		$1.65/100 ft(3)					
10 Overall (per year)		$96,279.00					
11		N/A					
12 Method of Management (2)		POTW &TSDF					
13							
Priority Rating Criteria (3)	Relative Wt. (W)	Rating (R)	RxW	Rating (R)	RxW	Rating (R)	RxW
Regulatory Compliance	10.0	4.0	40.0				
Treatment/Disposal Cost	9.0	1.0	9.0				
Potential Liability	10.0	5.0	50.0				
Waste Quantity Generated	7.0	10.0	70.0				
Waste Hazard	8.0	4.0	32.0				
Safety Hazard	6.0	2.0	12.0				
Minimization Potential	5.0	10.0	50.0				
Potential to Remove Bottleneck	0.0	0.0	0.0				
Potential Byproduct Recovery	0.0	0.0	0.0				
Sum of Priority Scores		Σ(RxW)	253.0	Σ(RxW)		Σ(RxW)	
Priority Rank		3					

Notes:

1. Stream numbers should correspond to those used on process flow diagrams.
2. For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
3. Rate each stream in each category on a scale from 0 (none) to 10 (high).

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman
SITE	PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie
DATE-INITIAL 02/09/09 / DATE-REVISED 03/09/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1 / PAGE 1 OF 4

WORKSHEET 10

WASTE STREAM SUMMARY

EPA

Attribute	Description (1)		
	Stream No. 02-E	Stream No.	Stream No.
1 Waste Name/ID	Degreasing Solvent		
2 Source/Origin	Degreasing of Frame Rails		
3 Component/or Property of Concern	N/A		
4 Annual Generation Rate, units:	N/A		
5 Overall	20,210 #		
6 Component(s) of Concern	N/A		
7	N/A		
8 Cost of Disposal	N/A		
9 Unit Cost, $ per:	$.25/# (100)		
10 Overall (per year)	$.74/# (90/10)		
11	N/A		
12 Method of Management (2)	Off-site recycle		
13			

Priority Rating Criteria (3)	Relative Wt. (W)	Rating (R)	RxW	Rating (R)	RxW	Rating (R)	RxW
Regulatory Compliance	10.0	10.0	100.0				
Treatment/Disposal Cost	9.0	10.0	90.0				
Potential Liability	10.0	9.0	90.0				
Waste Quantity Generated	7.0	0.0	0.2				
Waste Hazard	8.0	10.0	80.0				
Safety Hazard	6.0	9.0	54.0				
Minimization Potential	5.0	4.0	20.0				
Potential to Remove Bottleneck	0.0	0.0	0.0				
Potential Byproduct Recovery	0.0	0.0	0.0				
Sum of Priority Scores		Σ(RxW)	434.2	Σ(RxW)		Σ(RxW)	
Priority Rank		1					

Notes:

1. Stream numbers should correspond to those used on process flow diagrams.
2. For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
3. Rate each stream in each category on a scale from 0 (none) to 10 (high).

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S Roman
SITE	PROC. UNIT/OPER. Spray Painting	CHECKED BY G Cushnie
DATE-INITIAL 02/09/09 / DATE-REVISED 03/09/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1 / PAGE 1 OF 4

WORKSHEET 10

WASTE STREAM SUMMARY

EPA

Attribute		Description (1)					
		Stream No. 03-F		Stream No. 03-G		Stream No. 03-H	
1 Waste Name/ID		Rinse Waters		Process Tanks 1,3,6		Phosphate Bath	
2 Source/Origin		Dip Tanks		Dip Tanks		Dip Tanks	
3 Component/or Property of Concern		N/A		N/A		N/A	
4 Annual Generation Rate, units:		N/A		N/A		N/A	
5 Overall		510,000 gal.		43,680 gal.		2,780 gal.	
6 Component(s) of Concern		N/A		N/A		N/A	
7		N/A		N/A		N/A	
8 Cost of Disposal		N/A		N/A		N/A	
9 Unit Cost, $ per:		$1.65/100ft(3)		$1.65/100ft(3)		$.24/gal.	
10 Overall (per year)		$62,944.00		$5,391.00		$667.00	
11		N/A		N/A		N/A	
12 Method of Management (2)		Pre-treatment onsite		Pre-treatment onsite		commercial TSDF	
13		& POTW		& POTW			
Priority Rating Criteria (3)	Relative Wt. (W)	Rating (R)	RxW	Rating (R)	RxW	Rating (R)	RxW
Regulatory Compliance	10.0	3.0	30.0	6.0	60.0	9.0	90.0
Treatment/Disposal Cost	9.0	1.0	9.0	1.0	9.0	0.3	2.7
Potential Liability	10.0	3.0	30.0	3.0	30.0	7.0	70.0
Waste Quantity Generated	7.0	6.5	45.5	0.5	3.5	0.0	0.3
Waste Hazard	8.0	3.0	24.0	7.0	56.0	10.0	80.0
Safety Hazard	6.0	2.0	12.0	6.0	36.0	5.0	30.0
Minimization Potential	5.0	7.0	35.0	5.0	25.0	2.0	10.0
Potential to Remove Bottleneck	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potential Byproduct Recovery	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum of Priority Scores		Σ(RxW)	185.5	Σ(RxW)	219.5	Σ(RxW)	283.0
Priority Rank		6		6		4	

Notes:

1. Stream numbers should correspond to those used on process flow diagrams.
2. For example, sanitary landfill, hazardous waste landfill, onsite recycle, incineration, combustion with heat recovery, distillation, dewatering, etc.
3. Rate each stream in each category on a scale from 0 (none) to 10 (high).

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 11

OPTION GENERATION

EPA

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

Meeting Coordinator: G. Cushnie

Meeting Participants:
The Truck Assembly Plant - EPA Contractor - SAIC, Chemical Supplier - Betz Metchem

LIST SUGGESTED OPTIONS	RATIONALE / REMARKS ON OPTION
1. In-house dewatering of the detackified paint with recycle of the water;	1. Reduces volume of sludge sent to the landfill
2. Sludge dryers	2. Reduces volume of sludge sent to the landfill
3. Inject paint catalyst as paint is sprayed	3. Recently implemented in one of the cab paint
	booths; keeps unused paint liquid so it can be used
	later
4. Ship leftover paint (custom colors) with the	4. Customers often request touch-up paint/must
finished truck	meet DOT regulations for shipping
5. Electrostatic Spray System	5. Increases transfer efficiency and reduces over-
	spray/Preliminary testing of this type of equipment
	has already been done increases price
	of spray guns and requires a power pack for each
	painter
6. Vapor-Injection-Curing	
7. Change painting procedures so that custom	7. Reduces VOCs, reduces amount of paint used/

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE i		PROC. UNIT/OPER. Spray Painting (Continued)	CHECKED BY G. Cushnie	
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WORKSHEET 11

OPTION GENERATION

EPA

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

Meeting Coordinator: G. Cushnie

Meeting Participants:
The Truck Assembly Plant - EPA Contractor - SAIC, Chemcial Supplier - Betz Metchem

LIST SUGGESTED OPTIONS	RATIONALE / REMARKS ON OPTION
designs don't require the entire part to be	increase masking time
painted the color of a stripe or design first	
before the maincab color is painted over it	
9. Install lock regulators on spray painting guns-	9. Lower air pressure reduces the amount of paint
	overspray/Spray guns in the Chasis Paint Booth
	currently have lock regulators
10. Closer regulation of paint mixed versus paint	10. the paint mixed in the paint mix
sprayed	room is returned unsprayed/closer tracking and
	careful estimating can reduce this
11. Monitor painting schedule to minimize wash	11. Painting has some control over its schedule and
sprayed	further monitoring can decrease washout
12. Robotics	12. Problems with "Orange Peel" on finished paint
	coat
13. Belt filter to dewater paint sludge and recycle	
water back to the paint booth	

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Degreasing of Frame Rails - Chassis	CHECKED BY G. Cushnie	
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WORKSHEET 11

OPTION GENERATION

EPA

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

Meeting Coordinator: G. Cushnie

Meeting Participants:
The Truck Assembly Plant - EPA Contractor - SAIC

LIST SUGGESTED OPTIONS	RATIONALE / REMARKS ON OPTION
1. Use Spray system to degrease entire chassis and	1. Produces no waste solvent or dirty rags/increases
omit wiping with rags	VOC emissions and the amount of solvent used
	increases.
2. Segregate rags and solvent	2. Solvent will remain uncontaminated and won't need
	to be disposed of as frequently thus decreasing the
	amount of solvent sent to disposal and the amount used.
3. Install a still to recover the spent solvent	3. Expensive; would require labor permits; etc. and
	volume of solvent gernerated doesn't warrant its
	installation.
4. Change type of solvent used	4. Current solvent produces the desired cleaning
	quality.
5. New rail washer	5. Reduces the amount of oil & grease on the chassis
	thus reducing the amoun of solvent used.

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Degreasing of Frame Pails - Chassis	CHECKED BY G. Cushnie	
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WORKSHEET 11

OPTION GENERATION

EPA

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

Meeting Coordinator: G. Cushnie

Meeting Participants:
The Truck Assembly Plant - EPA Contractor - SAIC, Chemical Supplier - Betz Metchem

LIST SUGGESTED OPTIONS	RATIONALE / REMARKS ON OPTION
1. IONexchange/ recycle of rinse waters	1. Reduces sludge volume sent off-site and amount of
	water used.
2. Phosphate Bath Maintenance	2. Bath can last from 3-5 years if maintained
	properly thus significantly decreasing raw materials
	used as well as amount sent to disposal.
3. Oil skimmers/filters	3. Remove oil and dirt build-up in the process tanks
	and extends the life of the chemicals in the tank.

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Belt Filter (OP-1)

Briefly Describe the Option:

This option involves the dewatering of detackified paint with the use of a belt filter. The detackified paint will be pumped from the pit and the paint sludge is deposited in a drum for disposal while the water is recycled to the paint booth.

Waste Stream(s) Affected:

01-C

Input Material(s) Affected:

City water

Product(s) Affected:

None

Indicate Type:

- ☒ **Source Reduction**
  - ☒ **Equipment-Related Change**
  - ☐ **Personnel/Procedure-Related Change**
  - ☐ **Materials-Related Change**
- ☒ **Recycling/Reuse**
  - ☒ **Onsite**
  - ☐ **Offsite**
  - ☒ **Material Reused for Original Purpose**
  - ☐ **Material Reused for Lower Quality Purpose**
  - ☐ **Material Sold**
  - ☐ **Material Burned for Heat Recovery**

Orignally Proposed By: The truck assembly plant   Date: 01/30/90

Reviewed By: SAIC   Date: 01/18/90

Approved for Study? ______ **yes** ______ **no**, By: ______

Reason for Acceptance or Rejection ______

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Improved Transfer Efficiency (OP-2)

Briefly Describe the Option:

Currently the cab paint booths have a transfer efficiency of approximately 35% and the chassis paint booth has a transfer efficiency of approximately 50%. The transfer efficiency can be increased up to 75-90% by switching to HVLP or electrostatic spray painting.

Waste Stream(s) Affected:

01-C, 01-D

Input Material(s) Affected:

Paint

Product(s) Affected:

None

Indicate Type:

- [X] Source Reduction
  - [X] Equipment-Related Change
  - [ ] Personnel/Procedure-Related Change
  - [ ] Materials-Related Change
- [ ] Recycling/Reuse
  - [ ] Onsite
  - [ ] Offsite
  - [ ] Material Reused for Original Purpose
  - [ ] Material Reused for Lower Quality Purpose
  - [ ] Material Sold
  - [ ] Material Burned for Heat Recovery

Orignally Proposed By: SAIC Date: 01/04/90

Reviewed By: SAIC Date: 01/18/90

Approved for Study? ______ yes ______ no, By: ______

Reason for Acceptance or Rejection ______

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Procedural/Small Equipment Changes (OP-3)

Briefly Describe the Option:

The facility is currently investigating a variety of procedural and small equipment changes which will streamline their waste minimization procedures. These include

- o shipping unused paint with the finished truck
- o adjusting the painting schedule
- o installing high/low pressure alarms
- o installing a digital display of air pressure
- o paint stripes and designs over the background color
- o installing mini-computers to check fluid flow

Waste Stream(s) Affected:

01-A, 01-B

Input Material(s) Affected:

Paint

Product(s) Affected:

None

Indicate Type:

- ☐ **Source Reduction**
  - ☒ **Equipment-Related Change**
  - ☒ **Personnel/Procedure-Related Change**
  - ☒ **Materials-Related Change**
- ☒ **Recycling/Reuse**
  - ☒ **Onsite**
  - ☐ **Offsite**
  - ☒ **Material Reused for Original Purpose**
  - ☐ **Material Reused for Lower Quality Purpose**
  - ☐ **Material Sold**
  - ☐ **Material Burned for Heat Recovery**

Orignally Proposed By: The truck assembly plant   Date: 01/04/90

Reviewed By: SAIC   Date: 01/18/90

Approved for Study? ______ **yes** ______ **no,** By: ______

Reason for Acceptance or Rejection ______

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Paint Mix Volumes (OP-4)

Briefly Describe the Option:

Paint is prepared daily in the paint mix room and is taken to the cab paint booths. Any left over paint is returned to the paint mix room for use at a later date. The facility has developed a tracking system to determine reliable estimates on the amount of paint required to paint a particular model. This is done by measuring the volumes of paint mixed as well as the volume of paint returned to the mix room. This estimating process can be refined with careful monitoring of these tracking records which will reduce costs for raw materials and disposal.

Waste Stream(s) Affected:

01-A, 01-B

Input Material(s) Affected:

Paint

Product(s) Affected:

None

Indicate Type:

- ☐ **Source Reduction**
  - ☐ **Equipment-Related Change**
  - ☒ **Personnel/Procedure-Related Change**
  - ☐ **Materials-Related Change**
- ☐ **Recycling/Reuse**
  - ☐ **Onsite** ☐ **Material Reused for Original Purpose**
  - ☐ **Offsite** ☐ **Material Reused for Lower Quality Purpose**
  - ☐ **Material Sold**
  - ☐ **Material Burned for Heat Recovery**

Orignally Proposed By: The truck assembly plant/SAIC Date: 01/04/90

Reviewed By: SAIC Date: 01/18/90

Approved for Study? ______ **yes** ______ **no, By:** ______

Reason for Acceptance or Rejection ______

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Solvent Segregation (OP-5)

Briefly Describe the Option:

This option involves the segregation of rags soiled with oil and grease from uncontaminated solvent. The rags will be kept in a separate container and dipped into the solvent just prior to use. When not in use they will remain in a container with other rags not soaking in a container of solvent.

Waste Stream(s) Affected:

02-E

Input Material(s) Affected:

Degreasing Solvent

Product(s) Affected:

None

Indicate Type:

- ☐ **Source Reduction**
  - ☐ **Equipment-Related Change**
  - ☒ **Personnel/Procedure-Related Change**
  - ☐ **Materials-Related Change**
- ☐ **Recycling/Reuse**
  - ☐ **Onsite**
  - ☐ **Offsite**
  - ☐ **Material Reused for Original Purpose**
  - ☐ **Material Reused for Lower Quality Purpose**
  - ☐ **Material Sold**
  - ☐ **Material Burned for Heat Recovery**

Orignally Proposed By: SAIC Date: 01/04/90

Reviewed By: SAIC Date: 01/18/90

Approved for Study? ________ yes ________ no, By: ________

Reason for Acceptance or Rejection ________

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE	PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: Ion Exhange/Recycle of Rinse Waters (OP-6)

Briefly Describe the Option:

This option involves the installation of ion exchange equipment to recycle the rinse waters generated on the phosphate/E-Coat line. The recycle of these waters will reduce water use and reduce the hydraulic loading of the pretreatment system. A smaller flow rate to the treatment system may reduce chemical use and sludge production.

Waste Stream(s) Affected:

03-F

Input Material(s) Affected:

None

Product(s) Affected:

None

Indicate Type:

- [ ] Source Reduction
  - [x] Equipment-Related Change
  - [ ] Personnel/Procedure-Related Change
  - [ ] Materials-Related Change
- [x] Recycling/Reuse
  - [x] Onsite
  - [ ] Offsite
  - [x] Material Reused for Original Purpose
  - [ ] Material Reused for Lower Quality Purpose
  - [ ] Material Sold
  - [ ] Material Burned for Heat Recovery

Orignally Proposed By: ____________ Date: ____________

Reviewed By: ____________ Date: ____________

Approved for Study? ______ yes ______ no, By: ____________

Reason for Acceptance or Rejection ____________

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER. Spray Painting	CHECKED BY G. Cushnie	
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WORKSHEET 12

OPTION DESCRIPTION

EPA

Option Name: E-Coat Line Bath Maintenance (OP-7)

Briefly Describe the Option:

This option involves the purchase of equipment to maintain the process solutions on the phosphate line (tanks 1, 3, and 6). The equipment is basically filtration units which will remove solids and oils contributed to the baths from the parts and the shop atmosphere.

Waste Stream(s) Affected:

03-G, 03-H

Input Material(s) Affected:
E-Coat process chemicals

Product(s) Affected:
None

Indicate Type:

- ☐ Source Reduction
  - ☒ Equipment-Related Change
  - ☐ Personnel/Procedure-Related Change
  - ☐ Materials-Related Change
- ☐ Recycling/Reuse
  - ☐ Onsite
  - ☐ Offsite
  - ☐ Material Reused for Original Purpose
  - ☐ Material Reused for Lower Quality Purpose
  - ☐ Material Sold
  - ☐ Material Burned for Heat Recovery

Orignally Proposed By: SAIC Date: 1/90

Reviewed By: SAIC Date: 2/90

Approved for Study? ________ yes ________ no, By: ________

Reason for Acceptance or Rejection ________

FIRM SAIC		WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman	
SITE		PROC. UNIT/OPER.	CHECKED BY G. Cushnie	
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WORKSHEET 13

OPTION GENERATION

EPA

Criteria	Weight (W)	Options Rating (R)									
		#1 Option OP-1		#2 Option OP-2		#3 Option OP-3		#4 Option OP-4		#5 Option OP-5	
		R	R X W	R	R X W	R	R X W	R	R X W	R	R X W
Reduction in waste's hazard	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Reduction of treatment/disposal costs	5.0	5.0	25.0	8.0	40.0	5.0	25.0	7.0	35.0	7.0	35.0
Reduction of safety hazard	7.0	1.0	7.0	4.0	28.0	1.0	7.0	1.0	7.0	1.0	7.0
Reduction of input material costs	9.0	1.0	9.0	7.0	63.0	3.0	27.0	7.0	63.0	6.0	54.0
Extent of current use in industry	10.0	8.0	80.0	8.0	80.0	5.0	50.0	5.0	50.0	5.0	50.0
Effect on product quality (no effect=10)	10.0	10.0	100.0	10.0	100.0	10.0	100.0	10.0	100.0	10.0	100.0
Low capital cost	8.0	5.0	40.0	2.0	16.0	4.0	32.0	8.0	64.0	9.0	72.0
Low O&M cost	8.0	5.0	40.0	8.0	64.0	8.0	64.0	7.0	56.0	9.0	72.0
Short implementation period	5.0	5.0	25.0	3.0	15.0	7.0	35.0	10.0	50.0	10.0	50.0
Ease of implementation	5.0	4.0	20.0	3.0	15.0	8.0	40.0	8.0	40.0	10.0	50.0
Final Evaluation	Sum of Weighted Ratings Σ (R X W)	348.0		423.0		382.0		467.0		492.0	
Final Evaluation	Option Ranking	7		3		5		2		1	
Feasibility Analysis Scheduled for (date)											

FIRM SAIC	WASTE MINIMIZATION ASSESSMENT	PREPARED BY S. Roman
SITE	PROC. UNIT/OPER.	CHECKED BY G. Cushnie
DATE-INITIAL 01/03/90 / DATE-REVISED 04/24/90	PROJ. NO. 1-832-03-942-02	SHEET 1 OF 1 / PAGE 1 OF 2

WORKSHEET 13

OPTION GENERATION

EPA

Criteria	Weight (W)	Options Rating (R)									
		#1 Option OP-6		#2 Option OP-7		#3 Option		#4 Option		#5 Option	
		R	R X W	R	R X W	R	R X W	R	R X W	R	R X W
Reduction in waste's hazard	2.0	1.0	2.0	1.0	2.0						
Reduction of treatment/disposal costs	5.0	5.0	25.0	5.0	25.0						
Reduction of safety hazard	7.0	1.0	7.0	1.0	7.0						
Reduction of input material costs	9.0	5.0	45.0	5.0	45.0						
Extent of current use in industry	10.0	8.0	80.0	6.0	60.0						
Effect on product quality (no effect=10)	10.0	9.0	90.0	8.0	80.0						
Low capital cost	8.0	4.0	32.0	5.0	40.0						
Low O&M cost	8.0	7.0	56.0	8.0	64.0						
Short implementation period	5.0	4.0	20.0	5.0	25.0						
Ease of implementation	5.0	6.0	30.0	5.0	25.0						
Final Evaluation: Sum of Weighted Ratings Σ (R X W)		387.0		373.0							
Final Evaluation: Option Ranking		4		6							
Feasibility Analysis Scheduled for (date)											

Appendix C

Feasibility Analysis Phase
Worksheets 14 to 17

Firm SAIC Site Date 1/3/90	Waste Minimization Assessment Proc. Unit/Oper. Proj. No. 1-832-03-942-02	Prepared By S. Roman Checked By G. Cushnie Sheet 1 of 6 Page 1 of 6

WORKSHEET 14a

TECHNICAL FEASIBILITY

EPA

WM Option Description Belt Filter (OP-1)

1. Nature of WM Option

- [X] **Equipment-Related**
- [ ] **Personnel/Procedure-Related**
- [ ] **Materials-Related**

2. If the option appears technically feasible, state your rationale for this. Belt filters have been used in similar applications to dewater detackified paint that has accumulated in the paint booth.

Is further analysis required? [X] **Yes** [ ] **No. If yes, continue with this worksheet. If not, skip to worksheet 15.**

3. Equipment - Related Option

	YES	NO	
Equipment available commercially?	X		
Demonstrated commercially?	X		
In similar application?	X		
Successfully?	X		

Describe closest industrial analog: Similar spray painting operations.

Describe status of development: Fully Developed and Commercialized.

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1.
Serfilco		Dan Cooper	2-6-90
Hydro-Seperation Systmes		Roy Lister	2-6-90

1. Also attach filled out phone conversation notes, installation visit report, etc.

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page ___ of ___

WORKSHEET **14b**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Belt Filter (OP-1)

3. Equipment-Related Option (continued)

Performance information required (describe parameters): The following information is required: minimum and maximum flow rates and percent solids achievable. This data can be generated by sending a representative sample of the wet sludge to an experiment vendor for testing.

Scaleup information required (describe): NONE

Testing Required: ☐ yes ☒ no

Scale: ☐ bench ☐ pilot ☐ ______

Test unit available? ☐ yes ☐ no ______

Test Parameters (list) ______

Number of test runs: ______

Amount of material(s) required: ______

Testing to be conducted: ☐ in-plant ☐ ______

Facility/Product Constraints:

Space Requirements Approximately 20 ft^2 (5.5' X 3.5')

Possible locations within facility Unit will be used every 4 to 6 weeks when the detackified paint is pumped out of the paint booth. During use it should be located where the paint sludge is being pumped from the booth. When not in use it can be stored on-site, wherever space is available or left in place if convenient.

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
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WORKSHEET **14c**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Belt Filter (OP-1)

2. Equipment-Related Option (continued)

Utility Requirements:

Electric Power — **Volts (AC or DC)** 115/1/60 **kW** 23

Process Water (Detackified Paint) — **Flow** 10-45gpm **Pressure** ___

Quality (tap, demin, etc.) ___

Cooling Water — **Flow** ___ **Pressure** ___

Temp. In ___ **Temp. Out** ___

Coolant/Heat Transfer Fluid ___

Temp. In ___ **Temp. Out** ___

Duty ___

Steam — **Pressure** ___ **Temp.** ___

Duty ___ **Flow** ___

Fuel — **Type** ___ **Flow** ___

Duty ___

Plant Air ___ **Flow** ___

Inert Gas ___ **Flow** ___

Estimated delivery time (after award of contract) 4 to 6 weeks

Estimated installation time 8 hours

Installation dates ___

Estimated production downtime none- production can continue during installation

Will production be otherwise affected? Explain the effect and impact on production. no

Will product quality be affected? Explain the effect on quality. no

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 4 of 6 Page __ of __

WORKSHEET 14d

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Belt Filter (OP-1)

3. Equipment-Related Option (continued)

Will modifications to work flow or production procedures be required? Explain. Detackified paint would need to be pumped to the belt filter instead of directly to a tank truck. Then water would be pumped back to the paint booth and reused.

Operator and maintenance training requirements

Number of people to be trained ______ ☐ **Onsite** ☐ **Offsite**

Duration of training

Describe catalyst, chemicals, replacement parts, or other supplies required.

Item	Rate or Frequency of Replacement	Supplier, Address
Disposa-Fabric Media	3-4-times per year	Serfilco, Glenview, IL

Does the option meet government and company safety and health requirements?

☐ **Yes** ☐ **No** **Explain** To be determined

How is service handled (maintenance and technical assistance)? Explain Service through local authorized repair centers or handles through the Serfilco office.

What warranties are offered? Serfilco - 1 year repair or replacement of defective parts.

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
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WORKSHEET **14e**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Belt Filter (OP-1)

3. Equipment-Related Option (continued)

Describe any additional storage or material handling requirements. The drum used to collect the filter media will . need to be removed when filled and replaced with a new drum.

Describe any additional laboratory or analytical requirements. one

4. Personnel/Procedure-Related Changes (skip to worksheet 15a)

Affected Departments/Areas ______

Training Requirements ______

Operating Instruction Changes. Describe responsible departments. ______

5. Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.)

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application. ______

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page __ of __

WORKSHEET 15a

COST INFORMATION

EPA

WM Option Description: Belt Filter (OP-1)

CAPITAL COSTS - Include all costs as appropriate. **TOTALS**

[X] **Purchased Process Equipment**

		TOTALS
Price (fob factory)	7,174 (complete filter system)	
Taxes, freight, insurance	430.00	
Delivered equipment cost	7,604.61	
Price for Initial Spare Parts Inventory		$7,605

[ ] **Estimated Materials Cost**

		TOTALS
Piping	Assume 20 percent of equipment	
Electrical		
Instruments		
Structural		
Insulation/Piping		$1,521

[ ] **Estimated Costs for Utility Connections and New Utility Systems**

		TOTALS
Electricity		
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		$ 0

[X] **Estimated Costs for Additional Equipment**

		TOTALS
Storage & Material Handling	55 gallon drums - use recycled drums	
Laboratory/Analytical		
Other		$ 0

[ ] **Site Preparation**

(Demolition, site clearing, etc.)

[X] **Estimated Installation Costs**

		TOTALS
Vendor		
Contractor		
In-house Staff	3 workers for 8 hrs @13 Hr.	$ 312

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper. Spray Painting	Checked By G. Cushnie
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WORKSHEET 15b

COST INFORMATION

(continued)

EPA

CAPITAL COSTS (Cont.) **TOTALS**

[X] **Engineering and Procurement Costs (In-house & outside)**

		TOTALS
Planning	Assume 20% of equipment costs	
Engineering		
Procurement		
Consultants		$1,521

[ ] **Start-up Costs**

		TOTALS
Vendor		
Contractor		
In-house		$0

[ ] **Training Costs** $0

[ ] **Permitting Costs**

		TOTALS
Fees		
In-house Staff Costs		$0

[ ] **Initial Charge of Catalysts and Chemicals**

		TOTALS
Item #1		
Item #2		$0

[X] **Working Capital [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].**

		TOTALS
Item #1	Disposa-Fabric media $192./200 yd. roll	
Item #2		
Item #3		
Item #4		

[ ] **Estimated Salvage Value (If any)**

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 3 of 6 Page ___ of ___

WORKSHEET 15c

COST INFORMATION

(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$ 7,605
Materials	1,521
Utility Connections	0
Additional Equipment	0
Site Preparation	0
Installation	321
Engineering and Procurement	1,521
Start-up Cost	0
Training Costs	0
Permitting Costs	0
Initial Charge of Catalysts and Chemicals	0
Fixed Capital Investment	$10,959
Working Capital	192
Total Capital Investment	11,151
Salvage Value	

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
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WORKSHEET 15d

COST INFORMATION

(continued)

EPA

[XX] **Estimated Decrease (or Increase) in Utilities**

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity	$.08/kw-hr	(239 KW. HR/YR)	($19/yr)
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

[X] **BASIS FOR COSTS** Annual X Quarterly ___ Monthly ___ Daily ___ Other ___

[X] **Estimated Disposal Cost Saving**

Assumes : 1.) 50% of sludge is from pit cleanout, 2.) 10% solids for wet sludge, and 3.) 35% solids for dewatered sludge

Decrease in TSDF Fees	$5,978 (includes Trans.)
Decrease in State Fees and Taxes	
Decrease in Transportation Costs	
Decrease in Onsite Treatment and Handling	
Decrease in Permitting, Reporting and Recordkeeping	
Total Decrease in Disposal Costs	$5,978

[XX] **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
City Water	$2.20/K Gal	780 K. Gal	$1,716
Booth Chemicals (SEE WS 7)	$80,907 Yr.	10%	$8,091
Total			$9,807

Assumes 50% reduction of booth water and 10% reduction of booth chemicals

Firm SAIC Site Date 1/3/90	Waste Minimization Assessment Proc. Unit/Oper. Proj. No. 1-832-03-942-02	Prepared By S. Roman Checked By G. Cushnie Sheet 5 of 6 Page __ of __

WORKSHEET **15e**

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Ancillary Catalysts and Chemicals**

Catalyst/Chemical	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time

☐ **Estimated Decrease (or Increase) in Operating Costs and Maintenance Labor Costs (include cost of supervision, benefits and burden).**

☒ **Estimated Decrease (or Increase) in Operating and Maintenance Supplies and Costs.**

Disposa- Fabric Media - 4 rolls @ $192 = $768

☐ **Estimated Decrease (or Increase) in Insurance and Liability Costs (explain).**

☐ **Estimated Decrease (or Increase) in Other Operating Costs (explain).**

INCREMENTAL REVENUES

☐ **Estimated Incremental Revenues from an Increase (or Decrease) in Production or Marketable By-products (explain).**

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	~~Proc.~~ Unit/Oper.	Checked By G. Cushnie
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WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$ 5,978
Decrease in Raw Materials Cost	$ 9,807
Decrease (or increase) in Utilities Cost	- (19)
Decrease (or increase) in Catalysts and Chemicals	$ 0
Decrease (or increase) in O & M Labor Costs	$ 0
Decrease (or increase) in O & M Supplies Costs	- (768)
Decrease (or increase) in Insurance/Liabilities Costs	$ 0
Decrease (or increase) in Other Operating Costs	$ 0
Incremental Revenues from Increased (Decreased) Production	$ 0
Incremental Revenues from Marketable By-products	$ 0
Net Operating Cost Savings	$14,998

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc Unit/Oper.	Checked By G. Cushnie
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WORKSHEET 16

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

Belt Filter (OP-1)

Total Capital Investment ($) (from Worksheet 15c) $11,151

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $14,998

Payback Period (in years) = $\frac{\textbf{Total Capital Investment}}{\textbf{Annual Net Operating Cost Savings}}$ = 0.7 year

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
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WORKSHEET **14a**

TECHNICAL FEASIBILITY

EPA

WM Option Description Transfer Efficiency (OP-2)

1. Nature of WM Option

- [x] Equipment-Related
- [ ] Personnel/Procedure-Related
- [ ] Materials-Related

2. If the option appears technically feasible, state your rationale for this. This proposed option includes equipment that is used for similar purposes in industry.

Is further analysis required? [x] Yes [ ] No. **If yes, continue with this worksheet. If not, skip to worksheet 15.**

3. Equipment - Related Option

	YES	NO	
Equipment available commercially?	[x]	[ ]	
Demonstrated commercially?	[x]	[ ]	
In similar application?	[x]	[ ]	
Successfully?	[x]	[ ]	

Describe closest industrial analog: Similar spray painting operations

Describe status of development: Fully developed and commercialized.

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1.
Binks- Blue Ridge Supply	703-249-3003	G. Batten	2/90

1. Also attach filled out phone conversation notes, installation visit report, etc.

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By C. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page __ of __

WORKSHEET **14b**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Transfer Efficiency (OP-2)

3. Equipment-Related Option (continued)

Performance Information required (describe parameters): Spray transfer efficiencies and effectiveness of coverage.

Scaleup Information required (describe): NONE

Testing Required: ☐ yes ☐ no

Scale: ☐ bench ☐ pilot ☒ Demonstation

Test unit available? ☐ yes ☐ no

Test Parameters (list)

Number of test runs:

Amount of material(s) required:

Testing to be conducted: ☒ in-plant ☐

Facility/Product Constraints:

Space Requirements Paint booths may require some enlargement.

Possible locations within facility Paint Spray Booths

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
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WORKSHEET **14c**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Transfer Efficiency (OP-2)

2. Equipment-Related Option (continued)

Utility Requirements: (All utilities as existing)

Electric Power Volts (AC or DC) ______ kW ______

Process Water Flow ______ Pressure ______

Quality (tap, demin, etc.) ______

Cooling Water Flow ______ Pressure ______

Temp. In ______ Temp. Out ______

Coolant/Heat Transfer Fluid ______

Temp. In ______ Temp. Out ______

Duty ______

Steam Pressure ______ Temp. ______

Duty ______ Flow ______

Fuel Type ______ Flow ______

Duty ______

Plant Air ______ Flow ______

Inert Gas ______ Flow ______

Estimated delivery time (after award of contract) 1 month

Estimated installation time 1 week

Installation dates preferrably during annual plant shut dowm

Estimated production downtime 1-2 days

Will production be otherwise affected? Explain the effect and impact on production. NO

Will product quality be affected? Explain the effect on quality. NO

Firm SAIC Site Date 1/3/90	**Waste Minimization Assessment** Proc. Unit/Oper. Proj. No. 1-832-03-942-02	Prepared By S. Roman Checked By C. Cushnie Sheet 4 of 6 Page ___ of ___

WORKSHEET **14d**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Transfer Efficiency (OP-2)

3. Equipment-Related Option (continued)

Will modifications to work flow or production procedures be required? Explain.

Operator and maintenance training requirements

Number of people to be trained 6-14

[XX] **Onsite**

[ ] **Offsite**

Duration of training 8 hours

Describe catalyst, chemicals, replacement parts, or other supplies required.

Item	Rate or Frequency of Replacement	Supplier, Address

Does the option meet government and company safety and health requirements?

[ ] **Yes** [ ] **No** **Explain** to be determined

How is service handled (maintenance and technical assistance)? Explain Not determined.

What warranties are offered? Will vary by manufacturer.

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
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WORKSHEET 14e

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Transfer Efficiency (OP-2)

3. **Equipment-Related Option (continued)**

Describe any additional storage or material handling requirements. NONE

Describe any additional laboratory or analytical requirements. NONE

4. **Personnel/Procedure-Related Changes** (skip to worksheet 15a)

Affected Departments/Areas

Training Requirements

Operating Instruction Changes. Describe responsible departments.

5. **Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.)**

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application.

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By ~~G. Cushnie~~
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WORKSHEET 15a

COST INFORMATION

EPA

WM Option Description Transfer Efficiency (OP-2)

CAPITAL COSTS - Include all costs as appropriate. **TOTALS**

[XX] Purchased Process Equipment

Price (fob factory)	New guns, power pack	
Taxes, freight, insurance		
Delivered equipment cost		
Price for Initial Spare Parts Inventory		$5,000

[ ] Estimated Materials Cost

Piping	see additional equipment below	
Electrical		
Instruments		
Structural		
Insulation/Piping		$ 0

[ ] Estimated Costs for Utility Connections and New Utility Systems

Electricity		
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		$ 0

[ ] Estimated Costs for Additional Equipment

Storage & Material Handling		
Laboratory/Analytical		
Other		$ 0

[XX] Site Preparation — Paint Booth reconstruction — $15,000

(Demolition, site clearing, etc.)

[ ] Estimated Installation Costs

Vendor		
Contractor		
In-house Staff		$ 0

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
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WORKSHEET 15b

COST INFORMATION

(continued)

EPA

CAPITAL COSTS (Cont.) — **TOTALS**

[X] **Engineering and Procurement Costs (In-house & outside)**

Planning	Assume 20% of equipment	
Engineering	and reconstruction costs	
Procurement		
Consultants		$ 4,000

[ ] **Start-up Costs**

Vendor	Assume 10% of equipment and	
Contractor	reconstruction costs.	
In-house		$2,000

[X] **Training Costs**	14 MEN X 8Hour $13 Hour	$1,456

[ ] **Permitting Costs**

Fees		
In-house Staff Costs		$ 0

[ ] **Initial Charge of Catalysts and Chemicals**

Item #1		
Item #2		$ 0

[ ] **Working Capital** [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].

Item #1		
Item #2		
Item #3		
Item #4		$ 0

[ ] **Estimated Salvage Value (If any)** — $ 0

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper. Option 2	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 3 of 6 Page __ of __

WORKSHEET **15c**

COST INFORMATION
(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$5,000
Materials	0
Utility Connections	0
Additional Equipment	0
Site Preparation	$15,000
Installation	0
Engineering and Procurement	4,000
Start-up Cost	2,000
Training Costs	1,456
Permitting Costs	
Initial Charge of Catalysts and Chemicals	
Fixed Capital Investment	$27,456
Working Capital	
Total Capital Investment	$27,456
Salvage Value	

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3//90	Proj. No. 1-832-03-942-02	Sheet 4 of 6 Page __ of __

WORKSHEET 15d

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Utilities** No significant cost changes expected

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity			
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

[X] **BASIS FOR COSTS** Annual X Quarterly ___ Monthly ___ Daily ___ Other___

[X] **Estimated Disposal Cost Saving**

ssume that 30% f painting is rame rails and that 30% efficiency ncrease for frame ails will be chieved.

Decrease in TSDF Fees	$1,498
Decrease in State Fees and Taxes	
Decrease in Transportation Costs	
Decrease in Onsite Treatment and Handling	
Decrease in Permitting, Reporting and Recordkeeping	
Total Decrease in Disposal Costs	$1,498

[X] **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
Imron Polyurethane Enamel	$40/gal	3,780 gpy	$151,200/yr

Firm SAIC	Waste Minimization Assessment	Prepared By ______
Site ______	Proc. Unit/Oper. ______	Checked By ______
Date ______	Proj. No. ______	Sheet 5 of 6 Page __ of __

WORKSHEET 15e

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Ancillary Catalysts and Chemicals**

Catalyst/Chemical	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time

☐ **Estimated Decrease (or Increase) in Operating Costs and Maintenance Labor Costs (include cost of supervision, benefits and burden).**

☐ **Estimated Decrease (or Increase) in Operating and Maintenance Supplies and Costs.**

☐ **Estimated Decrease (or Increase) in Insurance and Liability Costs (explain).**

☐ **Estimated Decrease (or Increase) in Other Operating Costs (explain).**

INCREMENTAL REVENUES

☐ **Estimated Incremental Revenues from an Increase (or Decrease) in Production or Marketable By-products (explain).**

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 6 of 6 Page __ of __

WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$ 1,498
Decrease in Raw Materials Cost	151,200
Decrease (or Increase) in Utilities Cost	0
Decrease (or Increase) in Catalysts and Chemicals	0
Decrease (or Increase) in O & M Labor Costs	0
Decrease (or Increase) in O & M Supplies Costs	0
Decrease (or Increase) in Insurance/Liabilities Costs	0
Decrease (or Increase) in Other Operating Costs	0
Incremental Revenues from Increased (Decreased) Production	0
Incremental Revenues from Marketable By-products	17
Net Operating Cost Savings	$ 152,698

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 1 Page __ of __

Option 2

WORKSHEET 16

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

Improved Transfer Efficiency (OP-2)

Total Capital Investment ($) (from Worksheet 15c) $27,456

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $152,698

Payback Period (in years) = $\frac{\text{Total Capital Investment}}{\text{Annual Net Operating Cost Savings}}$ = 0.2 years

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc./Unit/Oper. Spray Painting	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page __ of __

WORKSHEET 14a

TECHNICAL FEASIBILITY

EPA

WM Option Description Paint Mix Volume (OP-4)

1. **Nature of WM Option**
   - [ ] Equipment-Related
   - [X] Personnel/Procedure-Related
   - [ ] Materials-Related

2. **If the option appears technically feasible, state your rationale for this.** The facility is current tracking paint mixed volumes versus paint sprayed volumes and has achieved an average of 1.3 quarts of paint wasted per truck due to over mixing. Continued monitoring should be abe to decrease this to less than one quart.

   Is further analysis required? [X] **Yes** [ ] **No. If yes, continue with this worksheet. If not, skip to worksheet 15.**

3. **Equipment - Related Option** (Not applicable-skip to worksheet 14e)

	YES	NO	
Equipment available commercially?	[ ]	[ ]	
Demonstrated commercially?	[ ]	[ ]	
In similar application?	[ ]	[ ]	
Successfully?	[ ]	[ ]	

Describe closest industrial analog __________

Describe status of development __________

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1.

1. **Also attach filled out phone conversation notes, installation visit report, etc.**

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 5 of 6 Page __ of __

WORKSHEET 14e

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Paint Mix Volumes (OP-4)

3. Equipment-Related Option (continued)

Describe any additional storage or material handling requirements.

Describe any additional laboratory or analytical requirements.

4. Personnel/Procedure-Related Changes

Affected Departments/Areas Production Dept. / Paint Areas - personnel working in the paint mix room.

Training Requirements Personnel in the paint mix room are currently monitoring the volume of paint wasted due to over mixing and estimating the specific volume of paint needed for a particular model. The estimates will improve with time with a reduction in the amount of paint wasted due to overmixing.

Operating Instruction Changes. Describe responsible departments. None

5. Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.) (Skip to worksheet 15a)

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application.

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page ___ of ___

WORKSHEET **15a**

COST INFORMATION

EPA

WM Option Description Paint Mix Volume (OP-4)

CAPITAL COSTS - Include all costs as appropriate.		**TOTALS**
☐ **Purchased Process Equipment**		
Price (fob factory)		
Taxes, freight, insurance		
Delivered equipment cost		
Price for Initial Spare Parts Inventory		
☐ **Estimated Materials Cost**		
Piping		
Electrical		
Instruments		
Structural		
Insulation/Piping		
☐ **Estimated Costs for Utility Connections and New Utility Systems**		
Electricity		
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		
☒ **Estimated Costs for Additional Equipment**		
Storage & Material Handling		
Laboratory/Analytical	Scale - Already in use	
Other		$500.00
☐ **Site Preparation**		
(Demolition, site clearing, etc.)		
☐ **Estimated Installation Costs**		
Vendor		
Contractor		
In-house Staff		

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page __ of __

WORKSHEET 15b

COST INFORMATION

(continued)

EPA

CAPITAL COSTS (Cont.) **TOTALS**

[X] **Engineering and Procurement Costs (in-house & outside)**

Planning		
Engineering	100 Hr.@ $22.00/hr.	
Procurement		
Consultants		$2,200

[ ] **Start-up Costs**

Vendor		
Contractor		
In-house		

[ ] **Training Costs**

[ ] **Permitting Costs**

Fees		
In-house Staff Costs		

[ ] **Initial Charge of Catalysts and Chemicals**

Item #1		
Item #2		

[X] **Working Capital** [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].

Item #1	Log book to track volumes	
Item #2		
Item #3		
Item #4		$ 25.00 (yearly supply)

[ ] **Estimated Salvage Value (if any)**

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 3 of 6 Page of

WORKSHEET 15c

COST INFORMATION

(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$ 0
Materials	$ 0
Utility Connections	$ 0
Additional Equipment	$ 500
Site Preparation	$ 0
Installation	$ 0
Engineering and Procurement	$ 2,200
Start-up Cost	$ 0
Training Costs	$ 0
Permitting Costs	$ 0
Initial Charge of Catalysts and Chemicals	$ 0
Fixed Capital Investment	$ 2,700
Working Capital	$ 25
Total Capital Investment	$ 2,725
Salvage Value	$ 0

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-830-03-942-02	Sheet 4 of 6 Page __ of __

WORKSHEET 15d

COST INFORMATION

(continued)

EPA

[X] **Estimated Decrease (or Increase) in Utilities**

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity	$.08/kw-hr	(572 kw-hr 1 yr)	($46.00 1 yr)
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

[X] **BASIS FOR COSTS** Annual X Quarterly ____ Monthly ____ Daily ____ Other____

[X] **Estimated Disposal Cost Saving**

Assumes 0.3 qt. of paint saved per truck

Decrease in TSDF Fees	$496.00 (includes trans.)
Decrease in State Fees and Taxes	
Decrease in Transportation Costs	
Decrease in Onsite Treatment and Handling	
Decrease in Permitting, Reporting and Recordkeeping	
Total Decrease in Disposal Costs	$496.00

[ ] **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
Imron Poly-urethane Enamel	$40.00 gal	$647.25 gals	$25,890.00

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 5 of 6 Page ___ of ___

WORKSHEET 15e

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Ancillary Catalysts and Chemicals**

Catalyst/Chemical	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time

☐ **Estimated Decrease (or Increase) in Operating Costs and Maintenance Labor Costs (include cost of supervision, benefits and burden).**

☒ **Estimated Decrease (or Increase) in Operating and Maintenance Supplies and Costs.**

Logbooks will need to be purchased at an approximate cost of $25.00 per year

☐ **Estimated Decrease (or Increase) in Insurance and Liability Costs (explain).**

☐ **Estimated Decrease (or Increase) in Other Operating Costs (explain).**

INCREMENTAL REVENUES

☐ **Estimated Incremental Revenues from an Increase (or Decrease) in Production or Marketable By-products (explain).**

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushine
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 6 of 6 Page __ of __

WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$ 496
Decrease in Raw Materials Cost	$25,890
Decrease (or Increase) in Utilities Cost	$ - (46)
Decrease (or Increase) in Catalysts and Chemicals	$ 0
Decrease (or Increase) in O & M Labor Costs	$ 0
Decrease (or Increase) in O & M Supplies Costs	$ - (25)
Decrease (or Increase) in Insurance/Liabilities Costs	$ 0
Decrease (or Increase) in Other Operating Costs	$ 0
Incremental Revenues from Increased (Decreased) Production	$ 0
Incremental Revenues from Marketable By-products	$ 0
Net Operating Cost Savings	$26,315

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper.	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 1 Page __ of __

WORKSHEET 16

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

Paint MIx Volumes (OP-4)

Total Capital Investment ($) (from Worksheet 15c) $2,725

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $26,315

Payback Period (in years) = $\frac{\text{Total Capital Investment}}{\text{Annual Net Operating Cost Savings}}$ = 0.1 yr

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper. Spray Painting	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page 4 of 6

WORKSHEET 14a

TECHNICAL FEASIBILITY

EPA

WM Option Description Minimizing Degreasing Solvent Waste Volume (OP-5)

1. Nature of WM Option
   - [X] Equipment-Related
   - [ ] Personnel/Procedure-Related
   - [ ] Materials-Related

2. If the option appears technically feasible, state your rationale for this. This option requires the purchase of new solvent containers and changes to degreasing procedures. The equipment needed for the option has not yet been identified, but is assumed to exist.

Is further analysis required? [X] Yes [ ] No. If yes, continue with this worksheet. If not, skip to worksheet 15.

3. Equipment - Related Option

	YES	NO	
Equipment available commercially?	[ ]	[ ]	Unknown
Demonstrated commercially?	[ ]	[ ]	Unknown
In similar application?	[ ]	[ ]	Unknown
Successfully?	[ ]	[ ]	Unknown

Describe closest industrial analog n/a

Describe status of development n/a

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1

1. Also attach filled out phone conversation notes, installation visit report, etc.

Firm SAIC	Waste Minimization Assessment	Prepared By S.Roman
Site	Proc. Unit/Oper. Degreasing of Frame rail (chassis)	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page __ of __

WORKSHEET **14b**

TECHNICAL FEASIBILITY
(continued)

EPA

WM Option Description Solvent Segregation (OP-5)

3. Equipment-Related Option (continued)

Performance information required (describe parameters): n/a

Scaleup information required (describe): n/a

Testing Required: ☐ yes ☒ no

Scale: ☐ bench ☐ pilot ☐

Test unit available? ☐ yes ☐ no

Test Parameters (list)

Number of test runs: n/a

Amount of material(s) required: n/a

Testing to be conducted: ☐ in-plant ☐

Facility/Product Constraints:

Space Requirements No significant space requirements.

Possible locations within facility

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper. Degreasing of Frame Rails Chassis	Checked By G. Cushnie
Date	Proj. No. 1-832-03-942-02	Sheet 3 of 6 Page __ of __

WORKSHEET 14c

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Solvent Segregation (OP-5)

2. Equipment-Related Option (continued)

Utility Requirements: none

Electric Power	**Volts (AC or DC)**		**kW**	
Process Water	**Flow**		**Pressure**	
	Quality (tap, demin, etc.)			
Cooling Water	**Flow**		**Pressure**	
	Temp. In		**Temp. Out**	
Coolant/Heat Transfer Fluid				
	Temp. In		**Temp. Out**	
	Duty			
Steam	**Pressure**		**Temp.**	
	Duty		**Flow**	
Fuel	**Type**		**Flow**	
			Duty	
Plant Air			**Flow**	
Inert Gas			**Flow**	

Estimated delivery time (after award of contract) N/A

Estimated installation time N/A

Installation dates N/A

Estimated production downtime none

Will production be otherwise affected? Explain the effect and impact on production. Production will not be affected.

Will product quality be affected? Explain the effect on quality. Production quality will not be affected.

Firm SAIC	Waste Minimization Assessment Degreasing of Frame	Prepared By S. Roman
Site	Proc. Unit/Oper. Rails Chassis	Checked By G. Cushnie
Date	Proj. No. 1-832-03-942-02	Sheet 4 of 6 Page __ of __

WORKSHEET 14d

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Solvent Segregation

3. Equipment-Related Option (continued)

Will modifications to work flow or production procedures be required? Explain. Minor changes to procedures will be required, however there will be little impact to the overall degreasing / painting operation.

Operator and maintenance training requirements

Number of people to be trained 6

[X] Onsite

[ ] Offsite

Duration of training 21 hr.

Describe catalyst, chemicals, replacement parts, or other supplies required.

Item	Rate or Frequency of Replacement	Supplier, Address
None		

Does the option meet government and company safety and health requirements?

[X] Yes [ ] No Explain There are no anticipated impacts on the existing safety and health requirements.

How is service handled (maintenance and technical assistance)? Explain n/a

What warranties are offered? n/a

Firm SAIC Site Date	Waste Minimization Assessment Proc. Unit/Oper. Degreasing of Frame Rails Chassis Proj. No. 1-832-03-942-02	Prepared By S. Roman Checked By G. Cushnie Sheet 5 of 6 Page ___ of ___

WORKSHEET 14e

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description ______________________

3. Equipment-Related Option (continued)

Describe any additional storage or material handling requirements. None

Describe any additional laboratory or analytical requirements. None

4. Personnel/Procedure-Related Changes (Skip to Worksheet 15a)

Affected Departments/Areas ______________________

Training Requirements ______________________

Operating Instruction Changes. Describe responsible departments. ______________________

5. Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.)

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application. ______________________

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
Site	Proc. Unit/Oper. Degreasing of Frame Rails Chassis	Checked By G. Cushnie
Date	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page ___ of ___

WORKSHEET 15a

COST INFORMATION

EPA

WM Option Description Same as 14a

CAPITAL COSTS - Include all costs as appropriate.

		TOTALS
[X] Purchased Process Equipment		
Price (fob factory)	Est. 4 units @ $100 ea.	
Taxes, freight, insurance		
Delivered equipment cost		
Price for Initial Spare Parts Inventory		$400
[ ] Estimated Materials Cost		
Piping		
Electrical		
Instruments		
Structural		
Insulation/Piping		0
[ ] Estimated Costs for Utility Connections and New Utility Systems		
Electricity		
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		0
[ ] Estimated Costs for Additional Equipment		
Storage & Material Handling		
Laboratory/Analytical		
Other		0
[ ] Site Preparation		0
(Demolition, site clearing, etc.)		0
[ ] Estimated Installation Costs		
Vendor		
Contractor		
In-house Staff		0

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper. Degreasing of Frame Rails Chassis	Checked By G. Cushnie
Date	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page ___ of ___

WORKSHEET **15b**

COST INFORMATION

(continued)

EPA

CAPITAL COSTS (Cont.) **TOTALS**

☐ **Engineering and Procurement Costs (In-house & outside)**

		TOTALS
Planning		
Engineering	2 hr @ $23/hr	
Procurement		
Consultants		$46

☐ **Start-up Costs**

		TOTALS
Vendor		
Contractor		
In-house		0

☒ **Training Costs** — 6 operators for 15 minutes @ $13/hour — $20

☐ **Permitting Costs**

		TOTALS
Fees		
In-house Staff Costs		0

☐ **Initial Charge of Catalysts and Chemicals**

		TOTALS
Item #1		
Item #2		0

☐ **Working Capital** [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].

		TOTALS
Item #1		
Item #2		
Item #3		
Item #4		0

☐ **Estimated Salvage Value (if any)** — 0

Firm SAIC	**Waste Minimization Assessment**	Prepared By S. Roman
Site	Proc. Unit/Oper. ~~Rails Chassis~~ Degreasing of Frame	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 3 of 6 Page __ of __

WORKSHEET **15c**

COST INFORMATION

(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$400
Materials	0
Utility Connections	0
Additional Equipment	0
Site Preparation	0
Installation	0
Engineering and Procurement	$ 46
Start-up Cost	0
Training Costs	$ 20
Permitting Costs	0
Initial Charge of Catalysts and Chemicals	0
Fixed Capital Investment	$466
Working Capital	0
Total Capital Investment	$466
Salvage Value	0

Firm SAIC	Waste Minimization Assessment Degreasing of Frame	Prepared By S. Roman
Site ______	Proc. Unit/Oper. Rails Chassis	Checked By G. Cushnie
Date ~~1/3/90~~	Proj. No. 1-832-03-942-02	Sheet 4 of 6 Page __ of __

WORKSHEET 15d

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Utilities**

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity			
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

☐ **BASIS FOR COSTS** Annual ____ Quarterly ____ Monthly ____ Daily ____ Other ____

☒ **Estimated Disposal Cost Saving**

Decrease in TSDF Fees	$3,219
Decrease in State Fees and Taxes	
Decrease in Transportation Costs	
Decrease in Onsite Treatment and Handling	
Decrease in Permitting, Reporting and Recordkeeping	$3,219
Total Decrease in Disposal Costs	

☒ **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
K Special Blend-degreasing	$5.00/gal	2,800 gal/yr	$14,000
solvent			

Based on 20% decrease in the amount of solvent used and 30% for that which becomes contaminated and is then disposed.

Firm ______	Waste Minimization Assessment	Prepared By ______
Site ______	Proc. Unit/Oper. ______	Checked By ______
Date ______	Proj. No. ______	Sheet 5 of 6 Page __ of __

WORKSHEET 15e

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Ancillary Catalysts and Chemicals**

Catalyst/Chemical	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time

☐ **Estimated Decrease (or Increase) in Operating Costs and Maintenance Labor Costs (include cost of supervision, benefits and burden).**

☐ **Estimated Decrease (or Increase) in Operating and Maintenance Supplies and Costs.**

☐ **Estimated Decrease (or Increase) in Insurance and Liability Costs (explain).**

☐ **Estimated Decrease (or Increase) in Other Operating Costs (explain).**

INCREMENTAL REVENUES

☐ **Estimated Incremental Revenues from an Increase (or Decrease) in Production or Marketable By-products (explain).**

Firm SAIC	Waste Minimization Assessment Degreasing of Frame	Prepared By S. Roman
Site	Proc. Unit/Oper. Rail Chassis	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 6 of 6 Page __ of __

WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$ 3,219
Decrease in Raw Materials Cost	$14,000
Decrease (or Increase) in Utilities Cost	
Decrease (or Increase) in Catalysts and Chemicals	
Decrease (or Increase) in O & M Labor Costs	
Decrease (or Increase) in O & M Supplies Costs	
Decrease (or Increase) in Insurance/Liabilities Costs	
Decrease (or Increase) in Other Operating Costs	
Incremental Revenues from Increased (Decreased) Production	
Incremental Revenues from Marketable By-products	
Net Operating Cost Savings	$17, 219

Firm SAIC	Waste Minimization Assessment Degreasing of Frame	Prepared By S. Roman
Site	Proc. Unit/Oper. Rails Chassis	Checked By G. Cushnie
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 1 Page __ of __

WORKSHEET
16

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

Solvent Segregation (OP-5)

Total Capital Investment ($) (from Worksheet 15c) $466

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $17,219

Payback Period (in years) = $\frac{\text{Total Capital Investment}}{\text{Annual Net Operating Cost Savings}}$ = <.1 years

Firm SAIC	**Waste Minimization Assessment**	Prepared By C. Cushnie
Site	Proc. Unit/Oper. E-Coat	Checked By S. Roman
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 1 of 6 Page 5 of 6

WORKSHEET 14a

TECHNICAL FEASIBILITY

EPA

WM Option Description ION Exchange with Recycle of Rinse Water (OP-6)

1. Nature of WM Option
- [X] **Equipment-Related**
- [ ] **Personnel/Procedure-Related**
- [ ] **Materials-Related**

2. If the option appears technically feasible, state your rationale for this. Ion Exchange is a technology that is commonly used on metal finishing lines for recycling rinse waters.

Is further analysis required? [X] **Yes** [ ] **No. If yes, continue with this worksheet. If not, skip to worksheet 15.**

3. Equipment - Related Option

	YES	NO	
Equipment available commercially?	X		
Demonstrated commercially?	X		
In similar application?	X		
Successfully?	X		

Describe closest industrial analog Working systems are in place for the same applications.

Describe status of development Fully developed and commercialized

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1.
Numerous manufacturers/vendors			

1. **Also attach filled out phone conversation notes, installation visit report, etc.**

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
Site	Proc. Unit/Oper. E-Coat	Checked By S. Roman
Date 1/3/90	Proj. No. 1-832-03-942-02	Sheet 2 of 6 Page ___ of ___

WORKSHEET 14b

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Ion Exchange with Recycle of Rinse Water (OP-6)

3. Equipment-Related Option (continued)

Performance Information required (describe parameters): Bench scale testing is needed to select the proper ion exchange resin and to determine approximate resin capacity. Also testing is needed to reevaluate the existing chemical precipitation process to determine if the iron salts dosage could be reduced.

Scaleup Information required (describe): Described above.

Testing Required: [X] yes [ ] no

Scale: [X] bench [ ] pilot [ ] ______

Test unit available? [X] yes [ ] no Generally performed by vendor.

Test Parameters (list) Major anion and cations of concern.

Number of test runs: As needed.

Amount of material(s) required: As needed

Testing to be conducted: [ ] In-plant [X] At vendor's facility

Facility/Product Constraints:

Space Requirements ______

Possible locations within facility Near existing ion exchange equipment in waste treatment room.

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **14c**

TECHNICAL FEASIBILITY
(continued)

EPA

WM Option Description Ion Exchange with Recycle of Rinse Water (OP-6)

2. Equipment-Related Option (continued)

Utility Requirements: (Dependent on system selected)

Electric Power Volts (AC or DC) ____ kW ____

Process Water Flow ____ Pressure ____

Quality (tap, demin, etc.) ____

Cooling Water Flow ____ Pressure ____

Temp. In ____ Temp. Out ____

Coolant/Heat Transfer Fluid ____

Temp. In ____ Temp. Out ____

Duty ____

Steam Pressure ____ Temp. ____

Duty ____ Flow ____

Fuel Type ____ Flow ____

Duty ____

Plant Air ____ Flow ____

Inert Gas ____ Flow ____

Estimated delivery time (after award of contract) unknown

Estimated installation time Generally 2-4 wks

Installation dates ____

Estimated production downtime ____

Will production be otherwise affected? Explain the effect and impact on production. None expected.

Will product quality be affected? Explain the effect on quality. None expected

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 14d

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Ion Exchange with Recycle of Rinse Water (OP-6)

3. Equipment-Related Option (continued)

Will modifications to work flow or production procedures be required? Explain. No

Operator and maintenance training requirements

Number of people to be trained No additional persons to be trained

☐ Onsite

☐ Offsite

Duration of training

Describe catalyst, chemicals, replacement parts, or other supplies required.

Item	Rate or Frequency of Replacement	Supplier, Address
Cartridge Filters	Usually weekly	Numerous
Acid regenerant	As needed	Numerous
Caustic regenerant	As needed	Numerous

Does the option meet government and company safety and health requirements?

☐ Yes ☐ No Explain To be determined

How is service handled (maintenance and technical assistance)? Explain Varies among manufacturers.

What warranties are offered? Varies among manufacturers

Firm IC SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET **14e**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description Ion Exchange with Recycle of Rinse Water (OP-6)

3. Equipment-Related Option (continued)

Describe any additional storage or material handling requirements. System could be integrated w/ existing IX unit and utilize the same regenerate feed containers.

Describe any additional laboratory or analytical requirements.

4. Personnel/Procedure-Related Changes

Affected Departments/Areas

Training Requirements

Operating Instruction Changes. Describe responsible departments.

5. Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.)

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application.

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
Site	Proc. Unit/Oper. E-Coat	Checked By S. Roman ✓
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WORKSHEET 15a

COST INFORMATION

EPA

WM Option Description Ion Exchange with Recycle of Rinse Water (OP-6)

CAPITAL COSTS - Include all costs as appropriate. **TOTALS**

[X] **Purchased Process Equipment**

Price (fob factory)	Est. (installed)	
Taxes, freight, insurance		
Delivered equipment cost		
Price for Initial Spare Parts Inventory		30,000

[X] **Estimated Materials Cost**

Piping	Assume 20% of Price	
Electrical	~~Assume 10% of price~~	
Instruments		
Structural		
Insulation/Piping		9,000

[ ] **Estimated Costs for Utility Connections and New Utility Systems**

Electricity	Included above	
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		

[ ] **Estimated Costs for Additional Equipment**

Storage & Material Handling		
Laboratory/Analytical		
Other		

[ ] **Site Preparation**

(Demolition, site clearing, etc.)

[ ] **Estimated Installation Costs**

Vendor		
Contractor		
In-house Staff		

Firm SAIC Site Date 1/3/90	**Waste Minimization Assessment** Proc. Unit/Oper. E-Coat Proj. No. 1-832-03-942-02	Prepared By G. Cushnie Checked By S. Roman Sheet 2 of 6 Page __ of __

WORKSHEET 15b

COST INFORMATION

(continued)

EPA

CAPITAL COSTS (Cont.) — **TOTALS**

[X] **Engineering and Procurement Costs (In-house & outside)**

		TOTALS
Planning	Assume 20% of price	
Engineering		
Procurement		
Consultants		6,000

[ ] **Start-up Costs**

Vendor		
Contractor		
In-house		

[ ] **Training Costs**

[ ] **Permitting Costs**

Fees		
In-house Staff Costs		

[X] **Initial Charge of Catalysts and Chemicals**

Item #1	Estimate	
Item #2		500

[ ] **Working Capital [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].**

Item #1

Item #2

Item #3

Item #4

[ ] **Estimated Salvage Value (if any)**

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET **15c**

COST INFORMATION

(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$30,000
Materials	9,000
Utility Connections	0
Additional Equipment	0
Site Preparation	0
Installation	0
Engineering and Procurement	6,000
Start-up Cost	0
Training Costs	0
Permitting Costs	0
Initial Charge of Catalysts and Chemicals	500
Fixed Capital Investment	$45,500
Working Capital	0
Total Capital Investment	$45,500
Salvage Value	0

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 15d

COST INFORMATION

(continued)

EPA

[X] **Estimated Decrease (or Increase) in Utilities**

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity		Estimate	($200)
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

[X] **BASIS FOR COSTS** Annual X Quarterly ___ Monthly ___ Daily ___ Other ___

[X] **Estimated Disposal Cost Saving**

Assume 50% reduction of F019 sludge

Decrease in TSDF Fees	$6,169
Decrease in State Fees and Taxes	
Decrease in Transportation Costs	
Decrease in Onsite Treatment and Handling	
Decrease in Permitting, Reporting and Recordkeeping	
Total Decrease in Disposal Costs	$6,169

Assume 90% reduciton of water use on E-Coat line

[X] **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
Treatment Chemicals	$18,000/yr	50% reduction	$ 9,000/yr
City Water	$3.54/Kgal	1,170 K gal	4,142 /yr
Total			$ 13,142/yr

Firm SAIC Site Date 1/3;/90	**Waste Minimization Assessment** Proc. Unit/Oper. E-Coat Proj. No. 1-832-03-942-02	Prepared By G. Cushnie Checked By S. Roman Sheet 6 of 6 Page __ of __

WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$6,169
Decrease in Raw Materials Cost	$13,142
Decrease (or Increase) in Utilities Cost	(200)
Decrease (or Increase) in Catalysts and Chemicals	
Decrease (or Increase) in O & M Labor Costs	
Decrease (or Increase) in O & M Supplies Costs	
Decrease (or Increase) in Insurance/Liabilities Costs	
Decrease (or Increase) in Other Operating Costs	
Incremental Revenues from Increased (Decreased) Production	
Incremental Revenues from Marketable By-products	
Net Operating Cost Savings	$19,311

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **16**

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

Ion Exchange with Recycle of Rinse Water (OP-6)

Total Capital Investment ($) (from Worksheet 15c) $45,500

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $19,311

Payback Period (in years) = $\frac{\textbf{Total Capital Investment}}{\textbf{Annual Net Operating Cost Savings}}$ = 2.4

Firm SAIC	**Waste Minimization Assessment**	Prepared By C. Cushnie
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WORKSHEET **14a**

TECHNICAL FEASIBILITY

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

1. Nature of WM Option

- [X] **Equipment-Related**
- [ ] **Personnel/Procedure-Related**
- [ ] **Materials-Related**

2. If the option appears technically feasible, state your rationale for this. Bath maintenance is often employed on metal finishing lines to extend the useful life of process solution

Is further analysis required? [X] **Yes** [ ] **No. If yes, continue with this worksheet. If not, skip to worksheet 15.**

3. Equipment - Related Option

	YES	NO
Equipment available commercially?	[X]	[ ]
Demonstrated commercially?	[X]	[ ]
In similar application?	[X]	[ ]
Successfully?	[X]	[ ]

Describe closest industrial analog: Used for identical purpose at many sites.

Describe status of development: Fully developed and commercialized.

Prospective Vendor	Working Installation(s)	Contact Person(s)	Date Contacted 1.
Numerous			

1. **Also attach filled out phone conversation notes, installation visit report, etc.**

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **14b**

TECHNICAL FEASIBILITY
(continued)

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

3. Equipment-Related Option (continued)

Performance information required (describe parameters): The facility should coordinate any changes to the E-Coat line with chemical supplier to assure compatibility with the existing system.

Scaleup information required (describe): ________

Testing Required: ☐ yes ☐ no

Scale: ☐ bench ☐ pilot ☐ ________

Test unit available? ☐ yes ☐ no ________

Test Parameters (list) ________

Number of test runs: ________

Amount of material(s) required: ________

Testing to be conducted: ☐ in-plant ☐ ________

Facility/Product Constraints:

Space Requirements ________

Possible locations within facility ________

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **14c**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

2. Equipment-Related Option (continued)

Utility Requirements: Dependent on equiptment selected.

Electric Power Volts (AC or DC) ______ kW ______

Process Water Flow ______ Pressure ______

Quality (tap, demin, etc.) ______

Cooling Water Flow ______ Pressure ______

Temp. In ______ Temp. Out ______

Coolant/Heat Transfer Fluid ______

Temp. In ______ Temp. Out ______

Duty ______

Steam Pressure ______ Temp. ______

Duty ______ Flow ______

Fuel Type ______ Flow ______

Duty ______

Plant Air ______ Flow ______

Inert Gas ______ Flow ______

Estimated delivery time (after award of contract) ______

Estimated installation time ______

Installation dates ______

Estimated production downtime ______

Will production be otherwise affected? Explain the effect and impact on production. ______

Will product quality be affected? Explain the effect on quality. ______

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **14d**

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

3. Equipment-Related Option (continued)

Will modifications to work flow or production procedures be required? Explain.

Operator and maintenance training requirements

Number of people to be trained None

☐ **Onsite**

☐ **Offsite**

Duration of training

Describe catalyst, chemicals, replacement parts, or other supplies required.

Item	Rate or Frequency of Replacement	Supplier, Address
Filter Cartridges	As needed	Numerous

Does the option meet government and company safety and health requirements?

☐ **Yes** ☐ **No** **Explain** To be determined

How is service handled (maintenance and technical assistance)? Explain Dependant on vendor selected.

What warranties are offered? Dependant on vendor selected.

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 14e

TECHNICAL FEASIBILITY

(continued)

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

3. Equipment-Related Option (continued)

Describe any additional storage or material handling requirements. No significant changes to current operation.

Describe any additional laboratory or analytical requirements. More frequent bath analysis may be required.

4. Personnel/Procedure-Related Changes

Affected Departments/Areas

Training Requirements

Operating Instruction Changes. Describe responsible departments.

5. Materials-Related Changes (Note: If substantial changes in equipment are required, then handle the option as an equipment-related one.)

	Yes	No
Has the new material been demonstrated commercially?	☐	☐
In a similar application?	☐	☐
Successfully?	☐	☐

Describe closest application.

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET 15a

COST INFORMATION

EPA

WM Option Description E-Coat Line Bath Maintenance (OP-7)

CAPITAL COSTS - Include all costs as appropriate. **TOTALS**

[X] **Purchased Process Equipment**		
Price (fob factory)	Estimated cost is $2,000	
Taxes, freight, insurance	per process tank	
Delivered equipment cost		
Price for Initial Spare Parts Inventory		$6,000
[X] **Estimated Materials Cost**		
Piping	Assume 20% of price	
Electrical	Assume 10% of price	
Instruments		
Structural		
Insulation/Piping		1,800
[ ] **Estimated Costs for Utility Connections and New Utility Systems**		
Electricity	Assume 10% of price	
Steam		
Cooling Water		
Process Water		
Refrigeration		
Fuel (Gas or Oil)		
Plant Air		
Inert Gas		600
[ ] **Estimated Costs for Additional Equipment**		
Storage & Material Handling		
Laboratory/Analytical		
Other		
[ ] **Site Preparation**		
(Demolition, site clearing, etc.)		
[X] **Estimated Installation Costs**		
Vendor		
Contractor		
In-house Staff	Assume 20% of price	$1,200

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET 15b

COST INFORMATION
(continued)

EPA

CAPITAL COSTS (Cont.) — **TOTALS**

[X] **Engineering and Procurement Costs (In-house & outside)**

Planning	Assume total for E&P is 20%	
Engineering	of price	
Procurement		
Consultants		$1,200

[X] **Start-up Costs**

Vendor		
Contractor		
In-house	Assume 20% of price	$1,200

[ ] **Training Costs**

[ ] **Permitting Costs**

Fees		
In-house Staff Costs		

[ ] **Initial Charge of Catalysts and Chemicals**

Item #1		
Item #2		

[X] **Working Capital [Raw Materials, Product, Inventory, Materials and Supplies (not elsewhere specified)].**

Item #1	Assume 20% of price	
Item #2		
Item #3		
Item #4		$1,200

[ ] **Estimated Salvage Value (if any)** 0

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 15c

COST INFORMATION

(continued)

EPA

CAPITAL COST SUMMARY

Cost Item	Cost
Purchased Process Equipment	$ 6,000
Materials	1,800
Utility Connections	600
Additional Equipment	
Site Preparation	
Installation	1,200
Engineering and Procurement	1,200
Start-up Cost	1,200
Training Costs	
Permitting Costs	
Initial Charge of Catalysts and Chemicals	
Fixed Capital Investment	$12,000
Working Capital	1,200
Total Capital Investment	$13,200
Salvage Value	$ 0

Firm ~~SAIC~~	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET **15d**

COST INFORMATION

(continued)

EPA

[X] **Estimated Decrease (or Increase) in Utilities**

Utility	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time
Electricity		Estimated	$200/yr
Steam			
Cooling Process			
Process Water			
Refrigeration			
Fuel (Gas or Oil)			
Plant Air			
Inert Air			

INCREMENTAL OPERATING COSTS - Include all relevant operating savings. Estimate these costs on an incremental basis (i.e., as decreases or increases over existing costs).

[X] **BASIS FOR COSTS** Annual X Quarterly ___ Monthly ___ Daily ___ Other ___

[X] **Estimated Disposal Cost Saving**

Assumes 10% reduction of F019 sludge.

- **Decrease in TSDF Fees** $1,233
- **Decrease in State Fees and Taxes** ___
- **Decrease in Transportation Costs** ___
- **Decrease in Onsite Treatment and Handling** ___
- **Decrease in Permitting, Reporting and Recordkeeping** ___
- **Total Decrease in Disposal Costs** $1,233

[X] **Estimated Decrease in Raw Materials Consumption**

Materials	Unit Cost $ per unit	Reduction in Quantity Units per time	Decrease in Cost $ per time
Tanks 1,3,6,(see ws7)	6,330/yr	30% reduction	$1,899

Firm SAIC	**Waste Minimization Assessment**	Prepared By G. Cushnie
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WORKSHEET **15e**

COST INFORMATION

(continued)

EPA

☐ **Estimated Decrease (or Increase) in Ancillary Catalysts and Chemicals**

Catalyst/Chemical	Unit Cost $ per unit	Decrease (or Increase) in Quantity Unit per time	Total Decrease (or Increase) $ per time

☒ **Estimated Decrease (or Increase) in Operating Costs and Maintenance Labor Costs (include cost of supervision, benefits and burden).**

Increases in maintenance labor for equipment are expected to be balanced by decreases in labor for refomuiation at the baths.

☐ **Estimated Decrease (or Increase) in Operating and Maintenance Supplies and Costs.**

☐ **Estimated Decrease (or Increase) in Insurance and Liability Costs (explain).**

☐ **Estimated Decrease (or Increase) in Other Operating Costs (explain).**

INCREMENTAL REVENUES

☐ **Estimated Incremental Revenues from an Increase (or Decrease) in Production or Marketable By-products (explain).**

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 15 f

COST INFORMATION

(continued)

EPA

INCREMENTAL OPERATING COST AND REVENUE SUMMARY (ANNUAL BASIS)

Decreases in Operating Cost or Increases in Revenue are Positive.
Increases in Operating Cost or Decrease in Revenue are Negative.

Operating Cost/Revenue Item	$ per year
Decrease in Disposal Cost	$1,233
Decrease in Raw Materials Cost	$1,899
Decrease (or Increase) in Utilities Cost	200
Decrease (or Increase) in Catalysts and Chemicals	
Decrease (or Increase) in O & M Labor Costs	
Decrease (or Increase) in O & M Supplies Costs	
Decrease (or Increase) in Insurance/Liabilities Costs	
Decrease (or Increase) in Other Operating Costs	
Incremental Revenues from Increased (Decreased) Production	
Incremental Revenues from Marketable By-products	$3,332
Net Operating Cost Savings	

Firm SAIC	Waste Minimization Assessment	Prepared By G. Cushnie
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WORKSHEET 16

PROFITABILITY WORKSHEET # 1
PAYBACK PERIOD

EPA

E-Coat Line Bath Maintenance (OP-7)

Total Capital Investment ($) (from Worksheet 15c) $13,200

Annual Net Operating Cost Savings ($ per year) (from Worksheet 15f) $3,332

Payback Period (in years) = $\frac{\text{Total Capital Investment}}{\text{Annual Net Operating Cost Savings}}$ = 4.0 years

Firm SAIC	Waste Minimization Assessment	Prepared By S. Roman
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WORKSHEET 17

PROFITABILITY WORKSHEET #2
CASH FLOW FOR NPV, IRR

EPA

Cash incomes (such as net operating cost savings and salvage value) are shown as positive.
Cash outlays (such as capital investments and increased operating costs) are shown as negative.

Line		Constr. Year	Operating[1] Year							
		0	1	2	3	4	5	6	7	8
A	Fixed Capital Investment									
B	+ Working Capital									
C	Total Capital Investment									
D	Salvage Value[2]									
E	Net Operating Costs Savings									
F	- Interest on Loans									
G	- Depreciation									
H	Taxable Income									
I	- Income Tax[3]									
J	Aftertax Profit[3]									
K	+ Depreciation									
L	- Repayment of Loan Principal									
M	- Capital Investment (line C)									
N	+ Salvage Value (line D)									
O	Cash Flow									
P	Present Value of Cash Flow[4]									
Q	Net Present Value (NPV)[5]									
	Present Worth[6] (5% discount)	1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768
	(10% discount)	1.0000	0.9091	0.8264	0.7513	0.6830	0.6209	0.5645	0.5132	0.4665
	(15% discount)	1.0000	0.8696	0.7581	0.6575	0.5718	0.4972	0.4323	0.3759	0.3269
	(20% discount)	1.0000	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349	0.2791	0.2326
	(25% discount)	1.0000	0.8000	0.6400	0.5120	0.4096	0.3277	0.2621	0.2097	0.1678

1 Adjust table as necessary if the anticipated project life is less than or more than 8 years.
2 Salvage value includes scrap value of equipment plus sale of working capital minus demolition costs.
3. The worksheet is used for calculating an aftertax cash flow. For pretax cash flow, use an income tax rate of 0%.
4 The present value of the cash flow is equal to the cash flow multiplied by the present worth factor.
5 The net present value is the sum of the present value of the cash flow for that year and all of the preceding years.
6 The formula for the present worth factor is $\frac{1}{(1+r)^n}$ where n is years and r is the discount rate.
7 The internal rate of return (IRR) is the discount rate (r) that results in a net present value of zero over the life of the project.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/600/2-91/038	2.	3
4. TITLE AND SUBTITLE Waste Minimization Opportunity Assessment: A Class 8 Truck Assembly Plant		5. REPORT DATE 21 AUG 91
		6. PERFORMING ORGANIZATION CODE EPA/ORD
7. AUTHOR(S) Science Applications International Corporation (SAIC)		8. PERFORMING ORGANIZATION REPORT NO.
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Mary Ann Curran FTS 684-7837 (513) 569-7837

16. ABSTRACT

EPA has developed a systematic approach to identify and emplement options to reduce or eliminate hazardous waste. The approach is presented in a report entitled, "Waste Minimization Opportunity Assessment Manual" (EPA/625/7-88/003). This report describes the application of the waste minimization assessment procedures to a truck assembly facility in Chillicothe, Ohio. This facility volunteered to participate in the project and provided technical support during the study.

The relative comparison used in this study indicates that the best options appear to be: 1) reducing paint mix volumes through closer control, 2) minimizing solvent contamination by using a different working container and procedures and 3) improving transfer efficiency by installing electrostatic painting in the chassis booth. Two options ranked with moderately good scores: 1) dewatering paint solids and recycling the booth waters and chemicals and 2) using ion exchange to recycle the phosphate/E-coat rinse water. The option for bath maintenance on the phosphate/E-coat line ranked last, however still within a reasonable range. One option which recommended procedural and small equipment changes for painting was not evaluated during the feasibility analysis phase, because the costs and savings could not be projected at this time. The associated waste minimization techniques however appear to be technically and economically viable.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
painting, degreasing, coatings	waste minimization, waste reduction, truck manufacture, cab assembly	

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