3C811 PDF

PROPOSED FINAL

POLLUTION PREVENTION OPPORTUNITY ASSESSMENT

DOBBINS AIR RESERVE BASE, GEORGIA
GENERAL MITCHELL IAP-ARS, WISCONSIN
GRISSOM AIR RESERVE BASE, INDIANA
HOMESTEAD AIR RESERVE STATION, FLORIDA
MARCH AIR RESERVE BASE, CALIFORNIA
MINNEAPOLIS-ST. PAUL IAP-ARS, MINNESOTA
NIAGARA FALLS AIR RESERVE STATION, NEW YORK
PITTSBURGH IAP-ARS, PENNSYLVANIA
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1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES

This Pollution Prevention Opportunity Assessment (PPOA) is a major component of the Air Force Reserve Command (AFRC) Pollution Prevention Program and Pollution Prevention Strategic Plan (PPSP). The PPOA focuses on evaluating pollution prevention opportunities and assessing each opportunity for validity and effectiveness. This effort assesses all pollutant sources and examines material usage and waste generation by type and volume, and determines the most practical and economical options for pollution prevention. This generally involves examining each process involving a targeted substance to determine ways to avoid use or generation of that substance.

The primary objective of the PPOA is to identify Pollution Prevention Opportunities (PPOs) that may be needed to achieve USAF pollution prevention goals. These PPOs are evaluated for technical, environmental, and economic feasibility. The PPOA emphasizes projects, material substitutions, equipment purchases, and/or process changes that will reduce an installation's major waste streams or hazardous materials (HAZMAT) usage and aid bases in meeting their pollution prevention goals.

Complementing the information in the PPOA is a PPO database that is essentially the universe of all PPOs that can be implemented at AFRC bases. This computerized database will serve the bases by providing detailed information about existing and recommended PPOs. This PPO database and other information in the PPOA are used in the Strategic Plan to assist AFRC bases in meeting or exceeding USAF pollution prevention goals and reducing compliance costs and problems.

1.2 TECHNICAL APPROACH

The basic approach for preparing the PPOA was to collect key data from each AFRC base and to identify effective PPOs that would allow bases to achieve short- and long-term pollution prevention goals. The technical approach conducted to prepare this PPOA consisted of the following major efforts:

1. Reviewed numerous pollution prevention and related documents and plans to obtain important data on each base.

2. Visited all AFRC bases and obtained key information from interviews with shop and other base personnel to assess the status of the pollution prevention program at each base.

3. Prepared initial comprehensive lists of PPOs potentially feasible for the different pollution prevention program areas. The PPOs in these lists were then evaluated during the pollution prevention surveys to determine which PPOs should be subjected to further analysis.

2.0 POLLUTION PREVENTION OPPORTUNITY EVALUATION PROCESS

This section describes the process used by SEA for evaluating and screening the PPOs that are appropriate for AFRC bases. Subsection 2.1, Initial Consideration of PPOs and Screening Process, describes the process for screening the extensive list of possible PPOs down to a list that is technically, environmentally, and economically feasible.

Subsection 2.2, Collection and Exchange of PPO Information, discusses the methodology used during the pollution prevention surveys to collect and exchange key information for the PPOA and PPSP. Subsection 2.3, Research of PPOs, describes the research activities conducted to obtain further information on PPOs. Finally, Subsection 2.4, Final PPO List, provides a table that lists the PPOs that are feasible for implementation at the bases.

2.1 INITIAL CONSIDERATION OF PPOS AND SCREENING PROCESS

Determining the appropriate PPOs for use at AFRC bases is a step-wise process that involves evaluating and screening potential PPOs to develop a PPO list best suited to the operations and needs of AFRC bases.

The process begins with development of a comprehensive list of PPOs that might be applicable to the bases. This list was developed from prior experience and various documents including Air Force Model Shop Reports, DOD documents and on-line services, prior pollution prevention plans for AFRC bases, and EPA guidance and informational documents.

The list of PPOs was used by SEA during the site visits as a reference to develop PPOs for each shop. Upon examination of each shop, the PPOs that might be appropriate were selected and "bounced off" shop personnel for feedback and acceptability. Many potential PPOs on the comprehensive list were deemed to be inappropriate after inspection of the shops. Other suggested PPOs were also eliminated from further consideration, because the shop personnel had already tried or considered implementing the PPOs and determined them not to be feasible. Subsection 2.2 below describes the collection and exchange of PPO information during the site visits.

At the time of the site visits, some shop personnel were developing and evaluating PPOs for their own shops. These PPOs were also added to the list and were examined by SEA for further analysis. In addition, after site visits, other PPOs were added to the list in an effort to address a particular waste stream, HAZMAT, or other pollution prevention issue. These PPOs were added based on research by SEA.

The initial list of PPOs was then subjected to analysis by SEA engineers and scientists to determine which PPOs are technically, environmentally, and economically feasible for implementation at AFRC bases. Technically feasible means:

- The PPO technology is proven and commercially available.
- Applicable USAF Technical Orders (TOs) will not be usurped by the PPO.

Table 2-1. Pollution Prevention Site Survey Dates for Each AFRC Base

BASE	DATE SURVEYED
DOB	January 12-16, 1998
GMT	October 14-17, 1997
GRI	September 29-October 3, 1997
HOM	January 26-30, 1998
MAR	December 8-12, 1997
MSP	September 8-12, 1997
NFS	October 21-25, 1997
PIT	November 17-21, 1997
WST	March 2-6, 1998
WIL	February 23-27, 1998
YNG	October 20-24, 1997

The shops at each of the bases were visited by SEA to obtain the following information:

- Descriptions of shop activities and hazardous material usage and waste generation
- Descriptions of current pollution prevention equipment and projects
- Analysis and acceptance of current pollution prevention equipment by base personnel
- Descriptions of innovative and successful PPOs which could help other bases
- Need for additional PPOs
- Potential for PPOs suggested by SEA to be implemented.

In addition to obtaining important information from the base for the PPOA and PPSP, the site visits proved to be very successful in exchanging information on PPOs and related experiences between shop and environmental personnel at different bases. During the base visits, there were numerous cases where a pollution prevention problem noted at one or more bases was addressed by an innovative PPO at another base. This exchange of information, with SEA personnel as intermediaries, proved to be a tremendous source of recommended PPOs for AFRC bases.

2.3 RESEARCH OF PPOS

After preparing the list of PPOs appropriate for AFRC bases, further information was needed for many PPOs to complete the data fields in the database. Such information

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ATTACHMENT A RECOVERED MATERIAL ADVISORY NOTICE (RMAN) (AS OF NOVEMBER 1997)

ATTACHMENT B ADDITIONAL INFORMATION – PAPER AND PAPER PRODUCTS

included product and cost information, lists of vendors, and data on hazardous material substitutes.

To obtain this information, SEA searched the internet and contacted vendors, Pro-Act, GSA, and shop personnel. Research efforts also included review of literature available from EPA, state agencies, DoD sources, vendors, and trade journals. The results of these efforts were used to complete the information needs for each PPO provided in the database.

Throughout the research and survey activities, additional ideas for PPOs were generated. Many of these ideas were found to be practical for AFRC bases and were included in the database. However, some ideas were not practical at this time because they were not commercially available, were not proven to work at military or similar installations, or required extensive testing. Consequently, it is important to continue to research new or improved PPOs and update the database.

In addition, there are a few technologies and PPOs available that are included in the database, but are not recommended for use at AFRC bases. These PPOs are included to provide information about PPOs that some bases may consider in the future but are currently not feasible due to a poor cost/benefit ratio.

2.4 FINAL PPO LIST

After all of the data collection and research efforts were completed, a final list of PPOs was developed for inclusion in the Pollution Prevention Database and the PPSP. Presented below is a summary table of the PPOs that are feasible and are or could be implemented at the AFRC bases. Information provided for each of the PPOs in Table 2-2 includes PPO number, title, and a brief description of the PPO.

Table 2-2. PPOs that are Existing, Planned, or Recommended at AFRC Bases

PPO NO.	PPO NAME	PPO DESCRIPTION
Municipal Solid Waste		
MSW-1	On-Base Recycle Center	An on-base recycle center will allow the base to centrally collect and segregate different recyclable waste streams, which will lead to a greater percentage of the solid wastes being recycled, as well as cheaper solid waste disposal costs.
MSW-2	Improve MSW Recycling Program	This PPO involves the introduction of a full-scale recycling program to capture all recyclable goods that are currently entering the solid waste stream. This program will reduce solid waste disposal quantities and costs.
MSW-3	Quarterly Dumpster Inspections	Inspect dumpsters quarterly for the presence of recyclable materials.
MSW-4	On-Base Recycling of Wood, Asphalt, and Concrete	An industrial grinder can be rented annually to grind wood, asphalt, and concrete waste for reuse on-base.
MSW-5	Off-Base Recycling of Sand Applied to Roads in Winter	Excess sand that is applied to base roads in the winter is collected and taken to the local municipal authority's facility. The sand is then screened to remove foreign objects and brought back to the base for storage and reused the following winter.
MSW-6	Composting of Yard Wastes	Dispose of yard waste in compost piles located on or off-base instead of in the garbage as MSW.
MSW-7	Food Waste Processors	Food waste processors can be used to reduce the volume of food wastes being disposed as MSW from dining facilities.
MSW-8	Styrofoam Reduction and Recycling System	A solvent is used to reduce Styrofoam plates, cups, packing materials, etc., into a gel-like form that can be shipped off-site for recycling.
MSW-9	Construction and Demolition Waste Recycling	Construction and demolition waste from on-base projects are taken to off-base recycle centers for recycling.
Hazardous Waste		
HW-1	Encapsulating Absorbents for Spill Clean-Up	Improved absorbents that pass TCLP can be used to reduce the quantity of hazardous and industrial waste disposed.
HW-2	Efficient Oil/Water Separator Management	Better, more efficient management of oil/water separators will reduce the amount of hazardous and industrial waste generated.
HW-3	Reuse of JP-8 Aircraft Fuel	JP-8 fuel that is removed from aircraft during maintenance and other activities should be returned to the POL Complex for reuse whenever possible.
HW-4	Improve Gas Mask Canister Management	Improve gas mask canister management on base by using expired service life canisters during training and other non-critical exercises
HW-5	Plastic Bead Media Leasing	Spent plastic bead media is generated during paint stripping activities on many bases. This bead blast media can be leased through a broker to avoid having to dispose of the spent material as a hazardous waste.
HW-6	Selective Paint Filter Replacement	Paint booth filters can be inspected more carefully before they are changed out. The filters that appear less contaminated can be left in place until the next filter change. The status of those filters can be evaluated then.
HW-7	Use of Dissolvable Styrofoam Paint Booth Filters	Reduce the volume of waste generation by using Styrofoam paint booth filters for use in paint booths throughout AFRC. When the filters have been used they are dissolved in used paint thinner and disposed of with the liquid paint waste.

HW-8	*Bicarbonate of Soda Paint Stripping and Parts Cleaning*	*Use a bicarbonate of soda stripping unit to remove paint, grease, and dirt from aircraft parts and equipment.*

Table 2-2. PPOs that are Existing, Planned, or Recommended at AFRC Bases (continued)

PPO NO.	PPO NAME	PPO DESCRIPTION
HW-9	Segregation of Wastes at the C-130 Propulsion/Engine Shop	Segregate waste rags and absorbents used in the Propulsion/Engine Shop from the waste rags generated in other shops at the base. The Propulsion/Engine Shop rags can have trace levels of cadmium and need to be disposed of separately from other rags to reduce HW generation.
HW-10	Aqueous Jet Washer Waste Disposal	This PPO provides numerous alternatives for reducing the amount of hazardous waste generated from aqueous-based jet washers.
Industrial Waste		
IW-1	Improved Absorbent Management	Sound absorbent management practices can significantly reduce the amount of waste absorbent generated in a shop.
IW-2	Absorbent Reconditioning Program	Used absorbent pads and rags can be collected and processed under an absorbent reconditioning program. The absorbents are cleaned at the reconditioning facility and are distributed for reuse.
IW-3	Antifreeze Testing and Recycling	Antifreeze testing and antifreeze recycling units can be used in shops where a significant amount of antifreeze is changed out each year. The recycling unit processes waste antifreeze, separating water and other impurities from the antifreeze mixture. The processed antifreeze can then be reused.
IW-4	Motor Oil Testing	Use an oil analyzer in shops where oil and other lubricating fluids are changed out. The analyzer can detect if the oil is still serviceable, thereby permitting longer intervals between oil changes.
IW-5	Shop Rag Laundering	A majority of industrial shops use rags to wipe down greasy or oily equipment. The used shop rags are collected and replaced with newly laundered rags on an as-needed basis.
IW-6	Use of Rechargeable Batteries	Use a rechargeable alkaline battery system in place of disposable alkaline batteries. The use of rechargeable batteries will significantly reduce battery purchase costs as well as battery disposal costs and amounts.
IW-7	Dryer for Fuel Contaminated Absorbent	Fuel contaminated absorbent is put in a dryer unit which draws air through the absorbent to remove the volatile organics and water in the absorbent. The absorbent can then be reused.
IW-8	Microbial Breakdown of Petroleum Products	Microbial-based detergents are applied to petroleum spills or added to oil/water separators to breakdown the petroleum, essentially making the petroleum disappear.
EPA-17 Chemicals		
EPA-1	Product Substitution Methodology	This PPO provides the methodology needed to identify processes that are using hazardous materials so they can be replaced with non-hazardous substitute products.
EPA-2	Substitute for MEK in Fuel Cell Shop	Replace MEK with a less hazardous substitute at fuel cell repair shops.
EPA-3	Substitute for MEK in Corrosion Control Shops	Use non-EPA-17 chemical containing products to wipe down parts prior to painting in corrosion control shops.
EPA-4	Alternative Paint Gun Cleaner	Use N-Methyl-2-Pyrrolidone or mineral spirits to clean paint guns at the paint shop, instead of using EPA-17 containing solvents like methylene chloride and MEK.
EPA-5	Use Marking Inks in Place of Spray Paints	Use a non-EPA-17 marking ink in place of spray paints for marking and stenciling..

EPA-6	*Consolidate Paint Shops*	*Some bases have three or more paint shops. Numerous environmental benefits could be achieved by closing the under-used paint shops and consolidating their activities.*

Table 2-2. PPOs that are Existing, Planned, or Recommended at AFRC Bases (continued)

PPO NO.	PPO NAME	PPO DESCRIPTION
EPA-7	Include Base Tenants in the Hazmart Program	The Hazmart should begin handling all hazardous material inventory management operations and purchases for base tenants.
EPA-8	Improved Hazmart Procedures	Hazardous chemical usage and expired shelf-life wastes can be reduced by improving several Hazmart procedures.
Ozone Depleting Substances		
ODS-1	Refrigerant and Halon Substitutions	Substitute Class I ODSs with Class II ODSs or ODS-free materials in refrigerant or fire suppression systems.
ODS-2	ODS Equipment Survey and Leak Testing	Survey all ODS containing equipment to determine which equipment is not necessary and can be removed.
ODS-3	Substitute for Trichloroethane in C-130 Shops	Use isopropyl alcohol or another non-EPA-17 solvent instead of trichloroethane to wipe down aircraft parts.
Pesticides		
PST-1	Implement Integrated Pest Management	Control pests through a combination of biological, chemical, cultural, and physical control practices rather than solely using pesticides.
PST-2	Fertilizer Reductions on Landscaped Areas	Reduce fertilizer applications on lawns through improved landscaping techniques and an increased tolerance for an imperfect lawn.
Volatile Organic Compounds		
VOC-1	Compressed Natural Gas (and Propane) Vehicles	Eliminate VOC and other hazardous air emissions from gasoline and diesel powered vehicles by converting to dual-fuel gasoline/compressed natural gas vehicles.
VOC-2	Electric Vehicles	Eliminate VOC emissions from gasoline and diesel powered vehicles by converting to electric cars and trucks.
VOC-3	Electric Utility Carts and Bicycles	Prevent the emission of VOCs from gasoline-powered vehicles by using electric utility carts for transportation on-base.
VOC-4	Vinyl Lettering Machine	Use vinyl lettering to label and identify equipment, walls, and doors rather than using spray paints.
VOC-5	Painter Training	Train AFRC paint shop personnel to more efficiently perform their painting operations in an effort to reduce the amount of paint used and to lower VOC emissions and paint waste generation.
VOC-6	Electrostatic Paint Spray System	Use electrostatic painting equipment in place of conventional painting equipment.
VOC-7	Reduce/Eliminate Solvent Tanks	Remove all unnecessary solvent tanks and, where solvents are still needed, consolidate several tanks to one centrally-located tank.
VOC-8	Aqueous Parts Washers	Solvent-free, aqueous-based parts washers are used to replace solvent-based dip tanks for cleaning and degreasing dirty parts.
VOC-9	Mogas Vapor Recovery Systems	The Stage II vapor recovery system is designed to capture gasoline vapors that would escape into the atmosphere as vehicles are refueled.
VOC-10	Self-Priming Topcoat Polyurethanes	Self-priming topcoat polyurethanes are applied to parts without the need for a primer coating; therefore, only one coat of paint is needed.
VOC-11	Protective Coating for Aircraft	A protective coating is applied regularly to aircraft to protect the paint from dirt, grime, and friction, which reduces the need for touch-up painting.

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3.0 DETAILED INFORMATION ON RECOMMENDED PPOS

This section provides detailed information for each PPO considered technically, environmentally, and economically feasible for use at AFRC bases as described in Section 2.0. The following format is used for providing information on the PPOs:

PPO NUMBER
PPO NAME
PRIMARY PROGRAM AREA
FUNDING REQUIREMENTS
FUND APPROPRIATION
CURRENT PROCESS
NEW PROCESS
ENVIRONMENTAL BENEFITS
COSTS

This PPO information is drawn from the database of PPOs (the database is described in Section 4.2 of this plan). The PPOs are grouped according to pollution prevention program area. Where a PPO applies to more than one program area, it is listed only once under the primary area.

Exhibits 3-1 through 3-44 are the actual detailed PPO narratives.

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Exhibit 3-1. Pollution Prevention Opportunity Narrative: PPO No. MSW-1

OPPORTUNITY NAME: On-Base Recycle Center

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Recycling bins are located throughout the base and a solid waste contractor or base employee picks-up the recyclables from each building.

NEW PROCESS: An on-base recycling center will be created and staffed by base or contractor personnel. Recycling personnel will pick-up recyclable materials from locations throughout the base and take it to the recycling center. Recyclables will then be segregated and sorted into large bins to await pick-up by one overall solid waste contractor, a recycling facility's designated transporter, or by recycle center staff for transport to a recycling facility.

The development of a recycling center will make recycling more effective by allowing for segregation and accumulation of cost effective shipments of recyclables. This will increase the materials recycled and the revenue from the sale of recyclable material. If the recycle center employs a person(s) to pick-up recyclables at individual base locations, the increased convenience should induce more people to participate in the recycling program and, therefore more recyclables will be collected.

ENVIRONMENTAL BENEFIT: A recycle center could dramatically reduce the amount of solid waste disposed at a base. At bases where recycle centers are being utilized, solid waste disposed dropped at least 20 percent.

COST: The major cost associated with the implementation of a recycle center is the cost of personnel to operate it. At most AFRC bases one person would be required at a cost of about $40,000 annually including benefits. Personnel can either be in-house or contractor personnel. Some bases may have an existing building that could be used to house the operations. The estimated cost to retrofit an existing building and provide adequate equipment ranges from $10,000 to $100,000.

The average AFRC base disposes of 450 tons of MSW. The implementation of a recycle center could reduce solid waste disposal by at least 20 percent, which translates to about 90 tons at the average AFRC base. At a disposal cost of $75 per ton, annual savings would be $6,750.

Labor costs can be reduced substantially by hiring low security prisoners, as is done at Homestead ARS.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Recycle Center	*$60,000.00*	*$40,000.00*	*$6,750.00*	*($33,250.00)*	*None*

Exhibit 3-2. Pollution Prevention Opportunity Narrative: PPO No. MSW-2

OPPORTUNITY NAME: Improve MSW Recycling Program

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Most bases have a recycling program, although some bases are more successful than others. The actual components of each base's recycling program vary from base to base. Some bases use a contractor to collect and segregate recyclables, while other bases have their own staffed, on-base recycling center. Some bases constantly promote recycling and have strong support of the base commanders.

NEW PROCESS: The ideal MSW recycling program for AFRC bases incorporates most of the following pollution prevention techniques to reduce solid waste generation and increase recycling.

1. Obtain Support from Commanders: It can be difficult to meet MSW pollution prevention goals without the Commanders' support. To obtain their support, they should be advised of the environmental benefits of recycling, as well as the potential cost savings in solid waste disposal costs. Once they have given their support, the Commanders should communicate with all base personnel the importance of recycling to the mission of the base.

2. Increase Education and Awareness of the Recycling Program and Continually Promote Recycling: This aspect of the recycling program is probably the most important. A strong education and awareness program can make the difference between achieving and not achieving MSW pollution prevention goals. Some of the facets of an effective education program include regular communication of recycling procedures and initiatives to all personnel through memoranda, e-mails, and briefings; posting of signs in key areas; regular visits with personnel generating solid waste; and initiation of an awards program for recognizing outstanding recycling efforts. It is also important to continually promote the recycling program to ensure its continued success.

3. Ensure there are Enough Recycling Containers: It is important that enough recycling containers be made available at strategic locations throughout the base to ensure that personnel will put recyclables in them instead of a solid waste disposal container. The containers should also be sized appropriately to provide enough space for recyclables in between pickups. Typical locations where more recycling containers have been needed include dining and lounge facilities, BXs, VOQs, and recreation facilities.

4. Ensure Labels on Recycling Containers are Simple and Readily Visible: Labels on recycling containers should identify the recyclables allowed in them in simple, large letters. Color coding of labels or containers may also help to readily identify the type of recyclable container. Also the recycling bin covers can have different shaped holes for different types of recyclables. For

example, an aluminum can bin would have a small round hole and a magazine bin would have a long narrow hole.

5. Inspect Solid Waste Disposal Containers and Ensure Covers are Kept Closed: All solid waste disposal dumpsters should be inspected regularly for the presence of recyclable materials. If recyclables are found, note their presence in a log and advise the responsible supervisors of the problem. If these types of problems continue, a report of all offending organizations should be sent to the organization's supervisor or the Commander for corrective action. Inspections of dumpsters should also note if covers are kept closed. Storm water collected in dumpsters will increase disposal weights recorded by the contractor.

6. Obtain a "Good" Solid Waste Contractor: A good solid waste contractor can make a big difference in how much is recycled and in reducing disposal costs. Some of the characteristics of a good contractor include accurately reporting the weight of solid wastes disposed; providing good solid waste containers which have covers to keep out rain and snow; and recycling numerous types of materials and obtaining revenue for these materials to offset disposal costs.

7. Recycle as Many Types of Materials as Possible: There are numerous materials that can be recycled such as glass, tires, aluminum, metal, plastics, CDs, toner cartridges, and all kinds of paper (except yellow stickies). The more items that are recycled, the less waste is disposed.

8. Prepare a Comprehensive Solid Waste Management Plan (SWMP): A well prepared and comprehensive SWMP can be very effective in tracking and increasing recycling. To be effective it should be updated regularly.

9. Consider Setting up a Recycling Center: A recycling center staffed by a contractor or base person can be an effective method to collect, sort, and store recyclable materials until a cost-effective quantity can be accumulated. The center should also have compaction and bailing equipment to prepare recycled materials for shipping and thus obtain higher prices for the materials.

ENVIRONMENTAL BENEFIT: The environmental benefit of this PPO is that more wastes are recycled and, therefore, less solid waste is disposed in landfills or by incineration.

COST: Most of the recommended components of a comprehensive recycling program listed above require minimal capital or annual costs. In fact, all of these components will directly or indirectly lead to reductions in MSW disposal costs. The only component that requires more than a minimal cost, the recycling center, should provide some pay back from reduced costs for the MSW collection and disposal contractor.

Exhibit 3-3. Pollution Prevention Opportunity Narrative: PPO No. MSW-3

OPPORTUNITY NAME: Quarterly Dumpster Inspections

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: None

CURRENT PROCESS: Recycling is mostly an unsupervised, voluntary practice where base personnel are responsible for segregating their own recyclable materials from the trash and placing them in the appropriate disposal bin. Unfortunately, many recyclables continue to end up in the solid waste dumpsters where they are taken to a landfill or incinerator by a contractor.

NEW PROCESS: Quarterly solid waste dumpster inspections should be conducted at each building by base personnel. The inspections can be performed by CEV personnel, a shop-specific designated recycling supervisor or a QRP team representative. To ensure dumpsters are full, inspections should occur on the day prior to a scheduled pick-up. Inspections should consist of looking into dumpsters and making note of recyclable materials that are present. The inspector may need to open several trash bags to look for recyclables. The inspectors should wear coveralls and gloves to avoid getting dirty.

The best way to prevent the continued disposal of recyclable material is to confront building supervisors in person, and try to get them to comply with the recycling program. This process may be difficult at first, but should prove highly successful in the end. Additionally, survey findings can be reported to the EPC.

ENVIRONMENTAL BENEFIT: It is estimated that increased participation in the recycling program could reduce the amount of solid waste disposed by as much as 10 percent.

COST: Quarterly dumpster surveys, discussing with responsible area supervisors, and preparation of a brief report should take about two days. At a cost of $45 per hour, the total annual cost of this opportunity is $4,320. Using the average MSW disposed figure for an AFRC base of 450 tons and assuming solid waste disposal is decreased by 10 percent, the average base will reduce solid waste disposal costs by as much as $3,375 (assumes $75 per ton disposal costs).

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Quarterly Dumpster Inspections	*$0.00*	*$2,880.00*	*$3,380.00*	*$500.00*	*0*

Exhibit 3-4. Pollution Prevention Opportunity Narrative: PPO No. MSW-4

OPPORTUNITY NAME: On-Base Recycling of Wood, Asphalt, and Concrete

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: O&M

CURRENT PROCESS: Wood, construction, and demolition wastes from base projects are disposed in landfills.

NEW PROCESS: Wood, concrete, and asphalt wastes are accumulated in a storage area on base. Approximately once per year an industrial grinder is rented to grind these accumulated wastes for reuse. The shredded wood is used for mulch and soil stabilization. The shredded concrete and asphalt are used for surfacing roads and parking lots. The use of an industrial grinder may not be applicable at smaller bases because concrete and asphalt grinding equipment are very noisy and generate a lot of dust. To prevent dust, the material can be wet down prior to grinding

ENVIRONMENTAL BENEFIT: The environmental benefits include reduction of waste disposed in landfills and elimination of much of the virgin materials needs for mulch and gravel.

COST: There are no capital costs for this PPO. The annual costs are about $8,000 (5 days X 8 hours/day X $200/hour). The cost savings are variable depending on how much the recycled materials replace virgin material purchases and the cost of disposal of the wastes. The cost analysis for a base would probably show this PPO to be close to break even or slightly profitable.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Industrial Grinder	*$0.00*	*$8,000.00*	*$8,000.00*	*$0.00*	*0*

Exhibit 3-5. Pollution Prevention Opportunity Narrative: PPO No. MSW-5

OPPORTUNITY NAME: Off-Base Recycling of Sand Applied to Roads in Winter

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Sand that is applied to paved surfaces in the winter to prevent slipping is collected to prevent it from discharging to storm drains and is disposed in a landfill.

NEW PROCESS: The residual sand is collected from the roads and sidewalks as early as possible in the spring. This sand is taken to the local municipal authority's facility. At the facility, the collected sand is screened to remove foreign objects. The screened sand is then brought back to the base for storage and reuse the following winter.

This PPO is important for AFRC bases located in colder climates. It was first identified and implemented at MSP IAP ARS. Of course it is necessary to have access to a sand recycling facility to be able to implement this PPO.

ENVIRONMENTAL BENEFIT: The environmental benefits include reduction of sand wastes disposed in landfills and reduction of some of the virgin sand that would be needed in the winter.

COST: Some municipalities will screen the sand for free if the base delivers and picks-up themselves. The cost of delivery and picking up the sand are nominal when compared to the cost of purchasing new sand and the cost of disposing of the old sand. Therefore, there are no costs reported for this PPO.

Exhibit 3-6. Pollution Prevention Opportunity Narrative: PPO No. MSW-6

OPPORTUNITY NAME: Composting of Yard Wastes

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: A couple of bases are composting yard wastes either on-base or at a local off-base government operated site; however, most yard wastes are not composted. Yard wastes at most bases are either reused on-base, spread out in wooded areas, or sent off-site to a sanitary or yard waste landfill.

NEW PROCESS: There are many forms of composting, many of which are extremely expensive to implement and maintain. The forms of composting presented in this PPO are those best suited for AFRC bases and include participation in an existing off-base program or the operation of simple compost piles on-base. The first method, participation in an existing off-base program is obviously the easiest method. The base solid waste coordinator should research the availability of such a program and obtain approval to send wastes to the facility. If no such program exists locally, then the base may want to try the next method, operation of simple compost piles.

Operation of simple compost piles is only available to larger bases that have adequate acreage and can site compost piles away from residential and commercial neighbors. Such an operation would consist of managing two or more compost piles (one that is newer for adding new wastes to and one that is older for removing the good compost). The compost should consist of yard wastes (leaves, grass clippings, brush, etc) and wood chips (from chipping brush and branches).

According to a fact sheet on composting available from Cornell University, the piles should optimally be 6 to 10 feet high and 12 to 20 feet wide. The piles can be circular or rectangular in a long row, and the piles must be turned regularly. If the pile only has leaves, it can be turned as little as a few times per year, although more benefit will be obtained from turning as often as every two weeks. If there are grass clippings in the compost pile, then the pile may need to be turned as often as daily when the clippings are first added to the pile.

Composted material is rich in organic content and can be used on the base as mulch and ground cover for plants and shrubs around buildings. Compost can also be used as a soil amendment where it is mixed in with existing dirt to create a more fertile soil. If manpower is a problem and compost cannot be collected and spread on the base, the material can be dumped and quickly spread in a secluded area on base.

There are plenty of publications, fact sheets and online information on composting which can be obtained by searching the internet. A good site for procedural information is located at www.cals.cornell.edu/dept/compost. Another potential source of information is the Composting Council located in Alexandria, VA, telephone: (703) 739-2401.

ENVIRONMENTAL BENEFIT: The immediate benefit is diversion of part or all of the MSW stream consisting of yard wastes (depending on the present disposal methods). The secondary benefit is the production of compost which can be used on the base's improved grounds to replace fertilizer, mulch, and compost that are currently being purchased.

COST: Participation in an off-base composting program should cost no more than disposal of the wastes by the MSW contractor and likely would be far less. The costs for operation of simple compost piles are dependent on available equipment. Because such an operation is only practical for large bases with open land, it is assumed that the use of the land is free. Furthermore, a large base is likely to have adequate roads and grounds equipment to move the waste to the compost area, turn the pile, and chip the wood. Therefore, it is likely that no capital funds would be needed to implement a compost pile operation. Obviously, some labor will be required to accumulate and maintain the compost pile. This labor can be provided by existing roads and grounds resources, and essentially will replace the costs for obtaining new fertilizer, mulch, or compost.

Exhibit 3-7. Pollution Prevention Opportunity Narrative: PPO No. MSW-7

OPPORTUNITY NAME: Food Waste Processors

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Food wastes cleared from dishes at base dining facilities are disposed of with regular rubbish as MSW.

NEW PROCESS: Two types of food waste processors will be described in this PPO: food grinders that discharge to the sanitary sewer and food pulpers that reduce the volume of the waste prior to disposal as solid waste.

Food Grinder Process: Paper and plastic wastes are removed from plates and trays first and put in the trash. Then the food wastes are washed off the plates with a stream of water to a commercial food grinder. The grinder pulverizes the food and the mixed water and food stream is discharged to the sanitary sewer. The grinder works much like the food disposal on a sink in a household kitchen. (NOTE: Water consumption will increase substantially with this process.)

Food Pulper Process: All wastes from plates (including paper and plastic) are cleared off dishes and trays into the food pulper. The pulper grinds, compresses and dewaters the waste to reduce its volume prior to disposal in a solid waste container. The vendor claims up to 85% volume reductions and 5-10% weight reductions.

The food grinder PPO is currently in use at Westover ARB in the club dining facilities. The food pulper is relatively new and not known to be in use at any AFRC base.

ENVIRONMENTAL BENEFIT: The food grinder is the preferred process from an environmental standpoint because it removes the food waste from the solid waste stream. However, clogging of the sanitary sewer line from dining facilities may occur where these lines are narrow, have lots of bends or have had histories of clogging problems. Preventive maintenance can be effective in reducing clogging problems for some sewer lines.

The food pulper is an alternative to the food grinder for troublesome clogging of sewer lines. The food pulper still provides some environmental benefits of reducing the volume and weight of MSW disposed in a landfill. As an example, the vendor claims the pulper can reduce the number of trash bags of food wastes from plates from 7 bags to one bag.

Reductions in MSW from dining facilities for the food grinder and food pulper are estimated to be 75 percent and 5 percent, respectively.

COST: The capital costs for the food grinders and accessories range from $400 to $3,300 (GSA schedule) depending on the size unit needed. The capital cost for the food pulper is approximately $18,500. The costs for installation of these units are estimated to be between

$500 and $2000 depending on how close water and sewer connections are to the location where the equipment is to be located. Costs to maintain and provide electricity and water to the food grinder and food pulper units are estimated to be $800 and $300, respectively, per year.

If we assume a typical dining facility generates 15 tons per year of MSW, then the food grinder and food pulper would reduce this quantity to 3 tons and 14.2 tons, respectively, per year. Assuming an MSW disposal cost of $75/ton, the costs for disposal of MSW per dining facility for the current process, food grinder process, and food pulper process are $1,200, $300, and $1,140, respectively, per year.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Food Pulper	*$18,500.00*	*$1,440.00*	*$1,200.00*	*($240.00)*	*None*
Food Grinder	*$2,500.00*	*$1,100.00*	*$1,200.00*	*$100.00*	*25*

Exhibit 3-8. Pollution Prevention Opportunity Narrative: PPO No. MSW-8

OPPORTUNITY NAME: Styrofoam Reduction and Recycling System

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Waste Styrofoam plates, cups, packing materials, etc. from dining facilities, snack bars, BX facilities, and base supply are disposed in the MSW stream and most likely end up in a landfill.

NEW PROCESS: Waste Styrofoam plates, cups, packing materials, etc. are put into a machine that initially shreds the Styrofoam. Then the shredded Styrofoam is sprayed with a proprietary solvent to reduce it into a gel-like substance. This material is then shipped freight collect to the machine's vendor who send it to a recycling facility for reuse. The machine can process unwashed plates and cups, but large chunks of food and ice will need to be separated from the plates and cups.

ENVIRONMENTAL BENEFIT: The elimination of Styrofoam wastes from some organizations can significantly reduce the MSW disposal stream. In particular, those dining halls and snack bars that use Styrofoam cups and plates could dramatically reduce their MSW quantities. Furthermore, the waste Styrofoam can be reused as a product.

COST: The capital cost of the equipment to reduce Styrofoam wastes for a typical AFRC base ranges from $5,000 to $6,000. The unit cost for the proprietary solvent is about $20/gallon. Approximately one gallon of solvent can reduce the Styrofoam waste from 1,000 meals. For a base processing Styrofoam from a snack bar and a dining hall used on UTA weekends, and from some packing materials the annual costs could be estimated to be roughly $800 (equivalent to 40,000 meals). There are no costs for disposal or transportation of the solvent-Styrofoam mixture.

Currently, MSW disposal costs are roughly $75/ton. Assuming a meal generates 0.2 pounds, then 40,000 meals generates 4 tons of MSW. Consequently, the disposal costs for the Styrofoam from the equivalent 40,000 meals is about $300.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Styrofoam Recycling Machine	*$5,500.00*	*$800.00*	*$300.00*	*($500.00)*	*None*

Exhibit 3-9. Pollution Prevention Opportunity Narrative: PPO No. MSW-9

OPPORTUNITY NAME: Construction and Demolition Waste Recycling

PRIMARY PROGRAM AREA: Municipal Solid Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: The typical methods for disposal of construction and demolition (C&D) wastes include the following: 1) disposed of as municipal solid waste; 2) disposed of at a special off-base landfill for C&D waste; or 3) disposed on-base at an area designated for certain types of C&D waste. Recycling of C&D wastes is generally not practiced at AFRC bases.

NEW PROCESS: Most metropolitan areas of the country have local C&D waste recycling sites where these wastes can be taken for recycling. A search of the yellow pages and internet can usually result in several listings of recycle centers which recycle metals, concrete and asphalt, and other C&D wastes. A base should also consider recycling wood, asphalt and concrete on-site using the method described in PPO MSW-4.

Another aspect of this PPO is requiring construction and demolition contractors to take the C&D wastes from base projects to local C&D recycle centers. This is done by attaching to all C&D contracts key environmental specifications that contain language requiring all C&D wastes be taken to a recycling facility. Dobbins ARB has recently implemented this aspect of the PPO for their construction contracts, however the base has not yet had enough experience to determine the success of this PPO.

ENVIRONMENTAL BENEFIT: The recycling of C&D wastes reduces the amount of wastes that must be disposed in a landfill and reduces the virgin construction materials that must be produced.

COST: The costs for this PPO are extremely variable depending on the type of C&D wastes generated, availability of recycle centers, and contractor costs. Consequently no specific cost analysis is provided here. Generally, the net increase in costs to require a contractor to recycle the C&D wastes is projected to be marginal.

Exhibit 3-10. Pollution Prevention Opportunity Narrative: PPO No. HW-1

OPPORTUNITY NAME: Encapsulating Absorbents for Spill Clean-Up

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Most shops are currently using absorbent pads and rags or granular absorbents (e.g., Speedi-Dry) to wipe up fuel, oil, and other hazardous material spills. When the absorbents are saturated or the spill is absorbed, the absorbent material is collected in a drum and turned-in as either hazardous or industrial waste. New absorbent pads are then purchased to replace the used ones.

NEW PROCESS: A new type of sorbent material is available to clean-up hazardous material spills, and the resulting waste is not considered a hazardous waste. This material, called MoorDri-100, is typically more expensive than traditional sorbents, but can save on hazardous waste disposal costs. It should typically only be used to clean up spills of materials that would be considered a hazardous waste. For example, because oils are typically not considered a hazardous waste, it would be more cost effective to use standard sorbent material to clean up oil spills. On the other hand, MoorDri-100 would be good to use to clean-up a spill of benzene.

A search by staff at Robins AFB, GA for a new, more economical absorbent material for hazardous material spills led to the discovery of MoorDri-100. The criteria used to select a new hazardous material absorbent were it must: 1) be disposable by incineration (allowing receipt of a "Certificate of Destruction"); 2) absorb better than the material being used at the time (clay- and vermiculite-based absorbents); 3) be cost effective; 4) be easy to dispose of; and, 5) be easy to use. Robbins AFB staff examined products from 15 different vendors and found MoorDri-100 to be an outstanding performer based on all of the above criteria.

MoorDri-100 is manufactured by Shefford-Meade, Inc. of West Chester, PA. It is a natural chemical absorbent, neutralizer, and stabilizer. A fine dry powder, it absorbs, adsorbs, neutralizes, and permanently encapsulates inorganic and organic chemical spills. MoorDri-100 is a zeolite-based (hydrous aluminum silicate minerals), naturally absorbent material, that is combined with proprietary enzymes. The absorbent and enzymatic properties of the material combine to stabilize and treat a variety of substances including organic spills, flammable liquids, antifreeze, paints, oils, acids, and metal sludges. The spent MoorDri-100 when subject to Toxic Characteristic Leachate Procedure (TCLP) analysis, passes at concentrations less than 10 parts per million. According to staff, TCLP analyses have consistently been negative when MoorDri-100 was used. These analytical results mean that the used material can be disposed of as regular trash in some locations. State or local regulations may still prohibit disposal in municipal landfills.

Staff at Robins AFB have been using MoorDri-100 for over a year now, and want to get the word out about how pleased they have been with its performance. For more information, contact Mr. John Peck, WR-ALC/EMO, (912) 926-1176 or Shefford-Meade, Inc., (800) 555-7403.

Several other manufacturers make absorbent products that are supposed to pass TCLP. Some of these manufacturers are identified in the vendors list in the AFRC P2 Database.

ENVIRONMENTAL BENEFIT: Hazardous and/or industrial waste generation will be reduced dramatically with the use of MoorDri-100. An average AFRC base disposes of 7,500 pounds of absorbent waste/spill debris per year as hazardous or industrial waste. If MoorDri is used, bases can eliminate this waste stream entirely by disposing of these wastes with the regular trash.

COST: MoorDri-100 is more expensive to purchase than the granular types of absorbents ($2.00/lb vs. $.57/lb), but a significant portion of this cost is made up by being able to dispose of the spent MoorDri-100 as regular trash. An average base disposes of 7,500 lbs of absorbent waste/spill debris per year at a cost of $3,750 ($0.50/lb). The weight of the spill debris is about half absorbent and half spilled material. Therefore the cost to purchase sorbent is $2,138 compared to $7,500 for MoorDri-100. MSW disposal costs at $75/ton would be $281.

An additional cost factor that needs to be considered is the reduced need for sampling and analysis of waste MoorDri-100 absorbents. These reduced costs are difficult to quantify, but should be considered by each base when determining if this PPO should be implemented.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
MoorDri-100	*$0.00*	*$7,781.00*	*$5,888.00*	*($1,893.00)*	*None*

Exhibit 3-11. Pollution Prevention Opportunity Narrative: PPO No. HW-2

OPPORTUNITY NAME: Efficient Oil/Water Separator Management

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Oil/water separators are used by many AFRC shops to remove lighter-than-water components (usually fuels, oils, greases, solvents, etc.) prior to the water being discharged to a sanitary or storm sewer. They operate by allowing the oils, fuels, and similar products in wastewater to float to the top as the wastewater flow rate is reduced through the separator. During this process, grit and sediment that are heavier than water are also separated from the wastewater and settle to the bottom of the separator. Typically, separators are connected to trench or floor drains in shops where industrial operations occur or are used to treat storm water from the flightline, refueler parking and loading/unloading areas. Periodically, the accumulated oils and related products, as well as the sludge at the bottom of the separator are removed for disposal. Often, the materials removed from the separator exhibit characteristics of hazardous waste and must be disposed of accordingly. If hazardous waste constituents (e.g. AFFF) are introduced into the separator, the entire contents of the unit must be removed and disposed of, usually as hazardous waste. If detergents from washrack discharges or floor washing activities are allowed to enter the separator, accumulated oils, fuels, and solvents may be emulsified and "washed out" of the separator, causing potential environmental compliance problems.

NEW PROCESS: Improved oil/water separator operation will reduce or eliminate the hazardous waste generated from normal separator use. Improved separator operation consists of keeping the separator filled with water at all times; ensuring that floor and trench drains are clear of dirt, debris, and trash; instituting "dry cleanup" practices; allowing only acceptable waste streams to enter the separator; performing routine inspections; and instituting more efficient clean-out practices.

"Dry cleanup" practices are procedures for cleaning up incidental oil, fuel or grease spills without the use of water or other liquids (e.g. use of absorbent pads). The only acceptable waste stream for an oil/water separator is water containing oil, grease, fuel or other petroleum products resulting from incidental spills or releases in industrial areas. Alkaline detergents, solvents, and surfactants are prohibited, as well as AFFF, waste oil, emulsified petroleum products, and washrack discharges.

Oil/water separators should be inspected quarterly for the build-up of oil, debri, and sediments. If clean-out is required, several techniques can be employed to reduce the amount of waste generated. Debri and oil should be skimmed off the surface if possible. It is not necessary to clean out the entire contents of the separator; this practice generates too much waste. If a more thorough cleaning is required, the contents of the separator can be pumped into a portable tank for temporary storage while the bottom sludge is removed. The water in the tank can then be used to fill the separator back up.

ENVIRONMENTAL BENEFIT: Improved oil/water separator operation will greatly reduce the amount of hazardous waste generated from individual separators because they will accumulate less waste, less frequently. Unnecessary cleaning will be avoided by preventing the introduction of improper waste streams to the separator

COST: The economic benefit of improved oil/water separator operation is difficult to quantify since there are several variables for each separator at each base. In general, instituting improved operation should pose no additional costs, because no new material or labor costs are introduced by improving separator operation. Savings in hazardous waste disposal costs can be expected due to reductions in hazardous waste generation from separators.

Exhibit 3-12. Pollution Prevention Opportunity Narrative: PPO No. HW-3

OPPORTUNITY NAME: Reuse of JP-8 Aircraft Fuel

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Waste JP-8 aircraft fuel is generated from aircraft and AGE equipment maintenance operations and POL activities. This waste fuel may be sent off-base as hazardous or industrial waste.

NEW PROCESS: Much of this waste fuel is clean and should be returned to POL for testing, filtering, and reuse. Most of the time the fuel will be clean enough to meet the specifications for reuse in the aircraft. However, sometimes contamination exists that prevents its reuse. In these instances, the base should consider using the fuel in AGE equipment. If the base is getting a lot of off-specification fuel, it may need to reevaluate its receiving, dispensing, and maintenance procedures. JP-8 should not be mixed with other fuels, oils, solvents, etc. because the JP-8 will not meet specifications and will need to be disposed.

ENVIRONMENTAL BENEFIT: This PPO will reduce the amount of hazardous and industrial waste generated at the base.

COST: The base will be able to save a significant amount of money on the purchase and disposal of JP-8. It is assumed that bases that do not segregate their JP-8 are having to dispose of about 6,000 gallons per year at costs ranging from $0 to $8,000 depending upon local market conditions. If 98 percent of this fuel could be reused, the base could reduce almost all of its disposal costs. The base could also save $5,880 on the purchase of virgin JP-8 ($1.00/gal). Total savings to the base range from $5,880 to $13,720 per year (median savings = $9,800). It is assumed that there are no capital costs for this PPO.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
JP-8 Reuse	*$0.00*	*$0.00*	*$9,800.00*	*$9,800.00*	*0*

Exhibit 3-13. Pollution Prevention Opportunity Narrative: PPO No. HW-4

OPPORTUNITY NAME: Improve Gas Mask Canister Management

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Gas mask canisters are stored at bases for use during training and wartime missions. The canisters must be disposed of when their service life has been exceeded. Because the canisters contain chromium, they must be managed as hazardous waste.

NEW PROCESS: Bases should efficiently manage their gas mask canisters to reduce the quantity of hazardous waste generated. To begin, bases should try to avoid receiving new gas mask canisters that are already close to the end of their service. By doing so, bases will reduce the number of expired canisters generated. Technical Order 14P4-1-151 states that gas mask canisters that have exceeded their service life are usable against riot control agents and for training, provided they are not damaged. Instead of immediately discarding expired canisters as hazardous waste, bases should keep them and use them for fit-testing and training exercises. Some bases have found local agencies (e.g., police departments) to donate expired gas masks to. Also, bases should be aware of service life extensions that may apply to their current inventory of gas mask canisters.

Additionally, gas mask canister sets that must be disposed can be broken apart so that the hazardous (e.g., chromium containing) components can be segregated and disposed as a hazardous waste. This practice will reduce the quantity of hazardous waste generated.

ENVIRONMENTAL BENEFIT: By improving the management of gas mask canisters, the amount of canisters that become hazardous waste can be reduced. When the canisters expire, they are considered a hazardous waste due to the chromium compounds present in the charcoal filter. By utilizing expired gas mask canisters for training, new canisters can be saved for future use, thereby reducing the total number of canisters disposed of in a given year.

COST: There is no cost associated with the implementation of this opportunity. By reducing the amount of gas canisters disposed of each year, disposal costs will decrease.

Exhibit 3-14. Pollution Prevention Opportunity Narrative: PPO No. HW-5

OPPORTUNITY NAME: Plastic Bead Media Leasing

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Plastic bead media (PBM) is used to remove paint from aircraft parts and other metal surfaces to prepare them for painting. Structural Maintenance/Corrosion Control Shops began using PBM several years ago as a less hazardous replacement for methylene chloride and other chemical paint strippers. PBM is used in an enclosed cabinet. Inside the cabinet, paint chips and PBM dust are separated from the usable PBM during the stripping process. The paint chips and PBM dust must be disposed of as hazardous waste, because of the high levels of chromium and lead in the paint. At present, it is not possible to separate the paint chips from the broken-down plastic bead media so they must be disposed of together. The dust mixture is collected in a drum and turned in as a hazardous waste when full.

NEW PROCESS: Each installation using PBM stripping should consider leasing PBM from either U. S. Technology or Composite Leasing. The PBM is leased from these companies and is used by the base in the same manner as described above. However, the waste paint chip and PBM dust mixture is not disposed as a hazardous waste. Instead, the waste PBM is shipped back to the lessee where the mixture is then used to manufacture various products. The material is not labeled hazardous waste because it is a raw material that will be used by the leasing agent, and therefore, by RCRA definition, is not considered a waste The collection drums still need to be properly labeled as a hazardous material during storage and transport.

ENVIRONMENTAL BENEFIT: The objective of the PBM leasing program is the elimination of hazardous waste generated from paint stripping operations. By leasing PBM, bases can effectively and economically reduce their hazardous waste disposal. The blasting process remains the same, but by returning the spent blast media to the leasing agent, the base does not need to manage it as a hazardous waste. In other words, instead of being disposed of in a landfill, the PBM is incorporated into a manufactured product. A typical base will reduce its hazardous waste disposal numbers by 2,000 pounds if the lease program is used.

COST: Since there is no process change during the blasting part of this opportunity, no additional equipment is needed to participate in the leasing program. All of the costs for this opportunity are incorporated into the lease price of the blast media, and are generally quoted per pound, ranging from $1.50/pound up to $4.00/pound. The variability in pricing is due to three factors: the quantity of blast media used in a year, the location of the base in relation to a distributor, and the frequency of delivery. The more blast media ordered and the closer a distributor, the lower the unit price becomes. The average cost of PBM leasing is $2.00/pound, which includes delivery of the new media and removal of the spent media. A base using 2,000 pounds of blast media will spend $4,000 per year through the leasing program.

By way of comparison, PBM can be purchased outright at an average cost of $1.25/pound, which includes delivery; however, the base is still responsible for all costs associated with the disposal of the spent blast media. Disposal costs for spent plastic bead media average $1.50 per pound. This figure is based on costs from several AFRC bases. If a base generates 2,000 pounds of spent blast media each year, the cost of disposal can be as high as $3,000. In addition, the base will need to purchase 2,000 pounds of new blast media at a cost of $2,500, making total annual costs $5,500. Thus, leasing saves the typical base about $1,500 annually.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
PBM Leasing Program	$0.00	$4,000.00	$5,500.00	$1,500.00	0

Exhibit 3-15. Pollution Prevention Opportunity Narrative: PPO No. HW-6

OPPORTUNITY NAME: Selective Paint Filter Replacement

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Most shops that manage paint booths change their paint filters approximately every three months. In most cases, all of the filters are changed out regardless of how much paint they have collected. The filters are collected in drums and turned in as hazardous waste.

NEW PROCESS: The paint booth filters should be inspected more thoroughly before they are discarded. In most cases, paint over spray tends to collect more quickly in the filters in the middle and lower half of the exhaust wall, leaving the outer and higher perimeter filters much cleaner and less restrictive to the airflow from the paint booth. When the manometer indicates that the air flow rate through the paint booth is too low, the filters in the middle and lower half should be replaced while leaving the cleaner outer and upper filters in place. Assuming the manometer reading indicates adequate air flow, this practice can reduce paint filter usage and disposal substantially. Continue to inspect all the filters, changing only those that require changing.

ENVIRONMENTAL BENEFIT: Inspecting the paint booth filters before they are removed will help reduce the amount of filter waste generated. When disposed of, the filters are usually considered hazardous waste due to the lead and chromium that are present in enamel and oil-based paints. As much as a 30% reduction in filter waste can be achieved through effective management of the filter changes. For a typical base, this opportunity can eliminate nearly 60 pounds of paint filter waste.

COST: A typical base will use 50 paint filters in a year. At an average cost of $8.00 per filter, over the course of a year, a base will have spent $400 on new paint filters. In addition, the used paint filters are disposed of at a cost of $1.25/pound, or an average of $5.00 per filter. The total cost for disposal of the filters can exceed $250 per year, making total annual costs over $650; therefore, a 30% reduction in filter usage and waste would lead to a cost savings of approximately $200 per year.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Improved Filter Management	*$0.00*	*$455.00*	*$650.00*	*$195.00*	*0*

Exhibit 3-16. Pollution Prevention Opportunity Narrative: PPO No. HW-7

OPPORTUNITY NAME: Use of Dissolvable Styrofoam Paint Booth Filters

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: O&M

CURRENT PROCESS: Most AFRC bases are currently using either paper or fiberglass paint filters in their paint booths. These paint filters are changed approximately every three months and replaced with new filters. The old, contaminated filters are normally stuffed into drums for disposal as hazardous waste due to the lead and chromium compounds that are often present in the paint.

NEW PROCESS: Bases should consider using dissolvable Styrofoam paint filters in place of paper or fiberglass ones. The Styrofoam filters have the same dimensions as the conventional filters so they can be used without modifying the paint booth. Also, the new filters have a 98.72% efficiency rating, which is similar to paper or fiberglass filters. However, when the Styrofoam filters are disposed, they can actually be dissolved in a small pan of waste paint thinner or other solvent. The filters are completely broken down by the solvents and can be disposed of in the drum of waste paint/solvent that already exists in the paint shop. Not only does this eliminate any future handling of the filters, it also eliminates the disposal of the filters as a separate waste stream.

One drawback, however, is that Styrofoam filters need to be replaced more frequently than conventional filters, because the solvents in the paints start dissolving the filters causing them to clog sooner. The major benefit of dissolvable Styrofoam paint filters is that they take up a lot less space then conventional filters and effectively reduce the volume of waste being generated.

ENVIRONMENTAL BENEFIT: By implementing this opportunity, bases can effectively eliminate the disposal of used paint filters and reduce the volume of hazardous waste generated. When disposed of, the filters are considered hazardous due to the heavy metals often present in aircraft paint. Use of the Styrofoam paint filters will eliminate the disposal of approximately 50 paint filters annually, while slightly increasing the amount of paint related material generated. The weight of hazardous waste generated and disposed may not be reduced by this PPO, but the cost of disposal will be reduced.

COST: A typical base will use 50 paint filters each year. At an average cost of $8.00 per filter, over the course of a year, a base will spend $400 on new paint filters. In addition, the used paint filters are disposed of at a cost of $1.25/pound, or $10.00 per filter. This gives total annual costs for purchase and disposal of paint filters of $900.

Styrofoam paint filters can be purchased for approximately $6.00 per filter. If we assume two Styrofoam paint booth filters last as long as one conventional filter, then a typical base would use 100 Styrofoam filters. This gives total purchase costs of $600. Since the filters are dissolved in a paint thinner solution, there may be a slight increase in the amount of waste solvent-related

material disposed due to the added weight of the dissolved Styrofoam filters. Therefore, the increased costs for disposal of the paint wastes is estimated to be about $50.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Styrofoam Paint Filters	$0.00	$650.00	$650.00	$0.00	0

Exhibit 3-17. Pollution Prevention Opportunity Narrative: PPO No. HW-8

OPPORTUNITY NAME: Bicarbonate of Soda Paint Stripping and Parts Cleaning

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Most AFRC bases have eliminated the use of chemicals in their paint stripping operations, which is a vast improvement over earlier practices that included the use of methylene chloride, methyl ethyl ketone, and toluene to strip paint and to clean parts. Over the past few years, bases have switched from using chemical strippers to using abrasive stripping media. A majority of Corrosion Control Shops are now using abrasive media, such as sand, glass, plastic beads, aluminum oxide and dry ice (frozen carbon dioxide) to strip paint from and clean aircraft parts. During paint stripping operations, the paint is chipped off the surface and is incorporated into the blast media mixture. Since many paints contain heavy metals, this blast media/paint chip mixture is managed as a hazardous waste.

NEW PROCESS: Bases supporting major painting operations should consider using a bicarbonate of soda paint stripping unit. Units are available in many different models and can be used for a variety of tasks. A bicarbonate of soda stripping unit can be used to remove paint, rust, dirt, grease, oil, and carbon from a wide variety of surfaces. There are several options to choose from depending on the intended use. These increased capabilities make the bicarbonate stripping unit more diverse than plastic bead media stripping.

Shop personnel will have the option of selecting either a wet or dry blasting process. The basic wet-process utilizes a mixture of sodium bicarbonate (baking soda) and water as the blasting media. The pressure at which the blast media is sprayed can be adjusted for use on more sensitive parts. Also, the amount of bicarbonate in the water mixture can be regulated to help conserve the blast media. The wet process is commonly used when the painted surface is covered with oil or grease. The basic dry process sprays a fine stream of dry sodium bicarbonate at the surface to be cleaned. There is no water mixed with the bicarbonate during the dry process. The dry process is commonly used on dry, painted surfaces.

The blasting agent, generally sodium bicarbonate, is a non-toxic, odorless blast media that is available in many formulations. The choice of which type of media and what pressure to use depends on the sensitivity of the substrate and the type of surface preparation desired. The size and complexity of the part to be cleaned will dictate these parameters as well as the choice of equipment. In addition to the bicarbonate blasting unit, a centrifuge unit is needed to separate the paint chips from the wet or dry bicarbonate blast media. This segregation significantly reduces the amount of hazardous waste generated.

ENVIRONMENTAL BENEFIT: Bicarbonate of soda paint stripping generates very little in the way of hazardous or industrial waste. In contrast to typical blasting media, bicarbonate of soda is water-soluble so it is easily separated from the paint chips, which reduces the amount of waste generated by a significant amount. Paint chips and other coatings are separated from the

water/sodium bicarbonate mixture through the use of filters and centrifuges. Insoluble materials, such as paint chips and other coatings, are captured for disposal as hazardous waste, while the water-soluble blast media can usually be discharged to a floor drain.

Approximately 100 pounds of the paint chip waste will be generated each year, as compared to plastic bead media stripping, where upwards of 2,000 pounds of hazardous waste can be generated.

COST: Bicarbonate of soda stripping units are available in several models. The Aqua Miser Model E-25M lists for just under $39,000 on the GSA price sheet. A separate centrifuge unit, called the Aqua Klean, Model C-50M, lists for $8,000 on the GSA price sheet. An additional $10,000 should be set aside for installation. This equates to an initial capital cost of just under $57,000. Training is included in the purchase price for this equipment. Additionally, the bicarbonate blast media must be purchased at a cost of $26 per 50-pound bag. A typical base may use 100 bags of bicarbonate at a cost of $2,600 per year.

Disposal costs for this option are minimal when used with the Aqua Klean centrifuge. The centrifuge separates the paint chips from the blast media, dramatically reducing the amount of waste generation. A typical base will generate 100 pounds of paint chip waste in a year. The cost for disposal of this waste will be approximately $125, making total annual costs for this opportunity $2,750.

By way of comparison, plastic bead media leasing, which is being utilized by several AFRC bases, requires no initial capital investment. The only costs incurred through the use of the leasing program come from leasing the blast media itself. At a price of $2.00 per pound, if a base uses 2,000 pounds of blast media in a year, the total cost would be $4,000. This cost includes both delivery of new blast media and collection of the spent blast media. Because there are no residual wastes to be disposed of, there are no disposal costs for this option.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Bicarbonate of Soda Stripping	*$57,000.00*	*$2,750.00*	*$4,000.00*	*$1,250.00*	*46*

Exhibit 3-18. Pollution Prevention Opportunity Narrative: PPO No. HW-9

OPPORTUNITY NAME: Segregation of Wastes at the C-130 Propulsion/Engine Shop

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Currently some C-130 Propulsion/Engine Shops are collecting their shop rags and absorbent pads from all work functions in the same waste collection drum. The rags and absorbents that are used in conjunction with compressor blade activities are collected in the same drum as regular shop rags that are only contaminated with grease, oil, etc. Since wastes from compressor blade activities are contaminated with cadmium they must be managed as a hazardous waste and disposed of as such. The commingling of the cadmium-contaminated rags and absorbents with the other cadmium-free wastes increases the amount of hazardous waste that must be disposed.

NEW PROCESS: C-130 Propulsion/Engine Shops should manage their waste rags and absorbents in a way that prevents the commingling of cadmium-contaminated material with all other shop wastes. By doing this, only the materials that are contaminated with cadmium are managed as a hazardous waste and all other materials can be managed as an industrial waste. The cadmium-free rags can be managed under a rag laundering service that picks up used rags for cleaning while delivering newly laundered rags. Providing a separate drum for cadmium-contaminated materials will be the easiest, and most cost-effective method for keeping the two waste streams separate. An analysis can be performed periodically to determine or monitor the level of cadmium contamination in the rags used for compressor blade operation and maintenance

ENVIRONMENTAL BENEFIT: Separating the cadmium-contaminated waste stream from the other waste streams in the shops will reduce the amount of material disposed of as hazardous waste due to cadmium contamination. Depending on local and state regulations, the cadmium-free shop wastes can either be recycled, reconditioned, or disposed of as a non-hazardous industrial waste.

COST: There are no significant costs or cost savings associated with this opportunity, other than the cost of supplying an additional drum for the collection of cadmium-contaminated shop rags and absorbents and reduced hazardous waste disposal costs.

Exhibit 3-19. Pollution Prevention Opportunity Narrative: PPO No. HW-10

OPPORTUNITY NAME: Aqueous Jet Washer Waste Disposal

PRIMARY PROGRAM AREA: Hazardous Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Aqueous jet washers are being used to replace solvent parts washers in most maintenance shops. Unfortunately, the wastewater generated from the aqueous jet washers is being managed as a hazardous waste in most instances.

The operation of these units is similar to a large household dishwasher. Dirty parts rotate on a turntable and are sprayed with a high velocity mixture of hot water and detergent. The wash water is continuously filtered within the unit to remove dirt and grease. The water and detergent tank is typically between 30 and 80 gallons (depending on the size of the unit). Currently, most bases reuse the water in the unit for 3 to 12 months before removing the dirty wash water and collecting it in a drum. TCLP analyses taken by several different bases have shown that this waste is considered hazardous due to the build-up of RCRA-restricted metals; therefore, most bases are shipping this waste out with their DRMO contractors as hazardous waste.

NEW PROCESS: There are a number of alternatives available for reducing the amount of hazardous waste generated from these units. These alternatives can be used individually or in conjunction with one another. These alternatives are listed below:

1) Sanitary Sewer Discharge - This is the preferred method of disposal. The aqueous jet washers are physically piped to a nearby sanitary sewer line so the wash water can be discharged to the sanitary sewer after each use. This procedure prevents the build-up of dissolved metals in the wash solution so it never becomes a hazardous waste. Longer change-out frequencies that allow for several uses before discharge may be possible depending upon the nature of the parts being washed. If discharge of this waste is prohibited by the sanitary sewer operator, then the base should initiate negoitiations with them. Most sanitary sewer operators will be able to accept this waste without any problems. Some bases have access to industrial pretreatment units and industrial treatment systems. Discharge to these systems is another excellent alternative.

2) Wash Water Conservation - This alternative is somewhat labor intensive. On a monthly basis (actual frequency will depend upon usage), pump out the wash water and temporarily store it in a drum. Then remove the sludge at the bottom of the holding tank and put the wash water back into the holding tank. The water is never actually disposed and the volume of waste is dramatically reduced. The sludge can be accumualed in a nearby satellite accumulation point.

3) Fewer Aqueous Jet Washers - Bases should strongly consider discontinuing the purchase of new aqueous jet washers. At many bases there are already enough washers that adjacent shops can share units. These washers frequently are sitting idle and have the capacity to handle more use.

4) Lengthen Change-Out Frequency - If discharge to the sewer is not possible, then reduced change-out frequency should be considered. The change-out frequency could be extended from 12 to 24 months or more depending on frequency of use. Operators will need to add water and detergent to the units on a frequent basis. Several bases have been doing this for more than 18 months and have indicated that the dirty, murky wash water does not harm cleaning efficiency. This procedure will reduce the amount of waste that needs to be containerized and disposed.

ENVIRONMENTAL BENEFIT: If the washwater is discharged to the sanitary sewer, the wastewater will be properly treated at the treatment plant and less hazardous waste will be generated by the base. The other alternatives presented in this PPO will all help to reduce the total amount of hazardous waste generated.

COST: This cost analysis assumes that the typical base disposes of the wash water every six months, generating about 100 gallons of wastewater per year. The cost to dispose of 100 gallons of wash water is $800. If this waste stream is eliminated via discharge to the sewer, disposal costs will be virtually nothing. The cost of hooking each unit to the sewer will be about $2,000. The new method will also require the use of more water and detergent than the old method of reusing the water; therefore, operational costs will increase by about $200 per unit.

The other alternatives provided in this PPO do not require any capital expenditures and will reduce the amount of hazardous waste generated; the cost savings, however, would be impossible to quantify.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Sanitary Sewer Discharge	*$2,000.00*	*$200.00*	*$800.00*	*$600.00*	*3*

Exhibit 3-20. Pollution Prevention Opportunity Narrative: PPO No. IW-1

OPPORTUNITY NAME: Improved Absorbent Management

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: None

FUND APPROPRIATION: None

CURRENT PROCESS: Many shops use large 24-inch absorbent pads to wipe up small spills or contain small leaks. The pads are often discarded in the waste absorbent drum well before they are saturated, resulting in a large amount of absorbent pads being used up and disposed of throughout the course of a year. Many of these pads still have oil absorbing capacity.

NEW PROCESS: Often times absorbent pads are needed just to collect small drips, and use of a large pad is unnecessary and wasteful. Using smaller absorbent pads for wiping up or cleaning small spills is an excellent way to reduce the generation of waste absorbent pads. Pads can be purchased in a variety of sizes for use on different sized jobs. Also, absorbent pads that are only slightly used should not be discarded in the waste collection drum. They should be put aside for use at a later time when they can be used completely.

If shops are finding that their absorbent rags are fully saturated when they are putting them in the waste collection drum, they may want to consider purchasing an absorbent pad wringer. The wringer can be used to recover and recycle the POL product contained in the pad, and the used pad can either be reused or disposed. Several shops have complained, however, that wringers are messy, time consuming, and not that effective. Another way to reduce absorbent usage is by catching drips with drip pans, buckets, etc., instead of absorbents.

ENVIRONMENTAL BENEFIT: Better absorbent management can reduce the amount of waste absorbent disposed of by up to 50 percent. Use of smaller and fewer absorbent pads will effectively reduce the amount of used absorbents a shop generates over the course of a year. Not only does this result in fewer absorbents to dispose of, but it also reduces the amount of new absorbents purchased. A typical base can reduce its waste absorbent generation by as much as 1,000 pounds annually.

COST: A typical base generates 2,000 pounds of contaminated absorbents each year. At approximately $0.50/pound, a base will spend $1,000 disposing of the used absorbents. In addition, new absorbent pads have to be purchased at a cost of nearly $3,000, making total annual costs $4,000.

Sound absorbent management practices will reduce absorbent disposal and purchase costs by up to 50 percent; however, a conservative estimate of 25 percent will be used for developing cost estimates. A 25 percent reduction in absorbent use and disposal will result in annual savings of $1,250. If the base decides to purchase an absorbent pad wringer, there will be a one time capital cost of $1,000 for the unit.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Absorbent Management (w/ wringer)	$1,000.00	$3,000.00	$4,000.00	$1,000.00	1
Absorbent Management (w/o wringer)	$0.00	$3,000.00	$4,000.00	$1,000.00	0

Exhibit 3-21. Pollution Prevention Opportunity Narrative: PPO No. IW-2

OPPORTUNITY NAME: Absorbent Reconditioning Program

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: O&M

CURRENT PROCESS: Most shops are using absorbent pads and rags to wipe up fuel, oil, and other petroleum product spills. When the rags or pads are saturated or the spill is absorbed, the absorbent material is collected in a drum and turned-in as either hazardous or industrial waste. New absorbent pads are then purchased to replace the used ones.

NEW PROCESS: The maintenance shops that are currently disposing of their used absorbent pads should be given the opportunity to participate in an absorbent reconditioning program. The shops will continue to utilize the absorbent pads as they have in the past, however, the used absorbents will be collected on a monthly, semi-monthly, or on an as-needed basis by the contractor for delivery to a reconditioning facility. The shops have a choice of whether or not they wish to receive reconditioned absorbent pads from the facility or order new product from them.

At the reconditioning facility, the used absorbent pads are reconditioned using a dry cleaning process. They are cleaned with solvent to remove the organic compounds that may be present in the material. After the dry cleaning process, the absorbent pads are then rinsed with water several times to remove any inorganic compounds that may still be present. The newly reconditioned absorbent pads are then ready for redistribution.

ENVIRONMENTAL BENEFIT: Entering into an absorbent reconditioning program will substantially reduce the amount of waste absorbent disposed of by incineration or in a landfill. By using the reconditioned absorbents, a typical base can eliminate the disposal of approximately 2,000 pounds of absorbent pads each year.

COST: The cost for participation in an absorbent reconditioning program will vary with the amount of absorbent used, the location of the base, the types of absorbents used, and the types of chemicals present in the waste stream. The cost for reconditioning 100 pounds of used absorbents, or one full 55-gallon drum, is approximately $100, or $1 per pound. In return, the base will receive a 55-gallon drum of newly reconditioned absorbent for each drum collected. The base may choose to receive new, non-reconditioned absorbent material at an additional cost of $150-$200 per drum, depending on the type of absorbent requested.

A typical base will use twenty 100-pound drums of absorbent pads in a year. If the base chooses to receive reconditioned absorbent direct from the facility the charge per drum would be approximately $100 for each drum. Over the course of a year a base could expect to spend $2,000 participating in such a program. This cost for delivery may be higher for those bases that are located outside the immediate delivery area of the absorbent reconditioning facility.

Under current practices, a base using 20 drums of absorbents a year may spend over $5,000 for its absorbent pad usage. This figure includes the cost of purchasing new absorbent and the cost of disposing of the contaminated absorbent.

Use of an absorbent reconditioning program is not only cost effective, but it also reduces a large part of a base's industrial waste stream.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Absorbent Reconditioning Program	$0.00	$2,000.00	$5,000.00	$3,000.00	0

Exhibit 3-22. Pollution Prevention Opportunity Narrative: PPO No. IW-3

OPPORTUNITY NAME: Antifreeze Testing and Recycling

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Currently, some motor vehicle shops and most AGE shops change antifreeze based on either hours of operation or on mileage driven, and not on the condition of the antifreeze. Typically, the antifreeze is a 50:50 mixture of water and ethylene glycol with a small quantity of additives such as corrosion inhibitors and anti-foam agents. Over time, the condition of the antifreeze can be affected by both dissolved and suspended contaminants, alkalinity changes, and excess water. Antifreeze is changed out based on the recommended time or mileage limits and is stored in drums for either off-site disposal or recycling.

NEW PROCESS: Waste antifreeze generation can be minimized by changing antifreeze on an as-needed basis. An antifreeze freeze-point and corrosion test kit can be used to determine the serviceability of the used antifreeze. These test strips can determine an engine's protection against freeze-up, boil-over, and acid corrosion, with the existing antifreeze mixture. If the test shows the antifreeze to be in good condition, the servicing interval can be extended. Periodic testing of antifreeze with test strips will allow most vehicles to increase the service interval between antifreeze changes.

When fluid changes are necessary and large quantities of waste antifreeze are generated, the used antifreeze should be collected in drums and recycled on-site using an antifreeze recycling unit. The antifreeze recycling unit can process used antifreeze, separating water and other impurities from the concentrated ethylene glycol (EG). The recovered EG concentrate is then mixed with a reinhibitor additive to produce a quality, fully buffered antifreeze product which meets ASTM and SAE standards.

ENVIRONMENTAL BENEFIT: On-site testing and recycling of antifreeze will significantly reduce the amount of waste antifreeze disposed of by the service shops. As much as a 90% reduction in waste antifreeze generation will be realized. A typical base generating 400 gallons of waste antifreeze per year, will eliminate the disposal of 360 gallons of waste antifreeze. Since ethylene glycol, the main component in antifreeze, is toxic to animals and most plant-life, reduced generation minimizes the threat of contamination of the physical environment. There is a waste sludge generated during the recycling process that must be managed as a hazardous waste. If 400 gallons of antifreeze are recycled on base, then approximately 30 gallons of waste sludge will be generated.

COST: The cost of the test strips is negligible at around $0.22 per strip. The strips can be purchased at any automotive supply store.

Depending on the type and model of antifreeze recycling unit selected, the costs can range anywhere from $6,000 to upwards of $15,000 for a complete recycling unit, including all the

necessary start-up chemicals and equipment. For example, a Finish Thompson, Inc. recycling unit that is capable of recycling 15 gallons of coolant each cycle costs $5,000. (A typical cycle runs about 12 hours.) The start-up kit for this particular unit will cost just over $500. The start-up kit comes with all the necessary equipment to begin the coolant recycling process. For an initial investment of just under $6,000, a shop can begin to recycle its used antifreeze.

The annual costs for purchasing additional reinhibitor will vary depending on the amount of antifreeze recycled. One drum of reinhibitor can treat 200 gallons of used antifreeze at a cost of $165/drum. If a base recycles 400 gallons of antifreeze in a year, the cost for reinhibitor will be $330. The reinhibitor is added to the antifreeze product to bring its quality up to acceptable ASTM and SAE levels. New antifreeze will also need to be purchased periodically to replace coolant loss due to spills, leaks, and evaporation. Approximately 55 gallons of antifreeze will need to be purchased each year at a cost of $275.

The waste product generated during this process will have to be disposed of as a hazardous waste. Typical disposal costs for this waste stream average $8.00/gallon. The annual costs for the disposal of 30 gallons of sludge will be $240. The total annual cost for antifreeze recycling will be approximately $850.

The costs associated with the old process of purchasing new antifreeze and disposing of the used antifreeze will vary widely depending on antifreeze purchase and disposal costs. Assume a base will purchase 400 gallons of antifreeze in a year. At a cost of $5.00 per gallon, a base will spend roughly $2,000 on new antifreeze. If antifreeze disposal costs are $2.40 per gallon, a base generating 400 gallons of antifreeze will spend nearly $1,000 for disposal, making total annual costs approximately $3,000.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Recycling Unit	*$6,000.00*	*$850.00*	*$3,000.00*	*$2,150.00*	*3*

Exhibit 3-23. Pollution Prevention Opportunity Narrative: PPO No. IW-4

OPPORTUNITY NAME: Motor Oil Testing

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Many Vehicle Maintenance Shops and most AGE Shops service the motor oil in their vehicles and equipment based on hours of operation or mileage, and not on the condition of the oil. The duration and type of use a vehicle or piece of equipment endures will directly affect the condition of the oil. Contamination of the oil from oxidation, water, acids, fuels, and metals are responsible for the degradation of the oil quality. Because the level of contamination or degradation of the oil in question is not known, the oil is serviced regularly, based on mileage or hours of operation. Used oil is collected in 55-gallon drums or bulk storage tanks and is turned over to a contractor for recycling

NEW PROCESS: Used motor oil generation can be significantly reduced by testing the oil prior to servicing an engine. The oil testing unit analyzes different properties of the oil to determine if the oil has been degraded or if too many contaminants exist. If the testing unit determines that the oil is in good condition, the life of the oil can be extended. A single portable oil analysis instrument can be stored at a central location in a shop and be used to screen lubricating oils to detect oil degradation and contamination. In addition, the instrument can also be used to detect abnormal metal concentrations. The testing requires no special preparation; is complete in a matter of minutes; requires no special expertise on the part of the operator; and does not generate any waste.

ENVIRONMENTAL BENEFIT: By using an oil testing unit, a base has the potential to reduce the amount of oil changes, as well as used oil generated, by an estimated 35 percent. If a typical motor vehicle shop uses 1,000 gallons of motor oil a year, that shop will generate approximately 800 gallons of used motor oil (due to leakage, burnoff, and volatilization). An oil analyzer will reduce the shop's annual oil consumption by approximately 350 gallons, and the amount of used oil generated by nearly 280 gallons per year.

COST: Depending on the brand of oil testing unit selected, the costs will range from $500 to $1000 for a portable unit. The average cost for a portable unit is $750. Portable units have the advantage of being able to test oil at many different locations.

A typical Vehicle Maintenance Shop services 200 motor vehicles on a service interval of 3 months or 3,000 miles. A shop that generates 800 gallons of used oil annually can recycle the oil at an average cost of $1.00/gallon, for an annual cost of approximately $800. In addition, a shop will need to purchase 1,000 gallons of new oil annually. At an average cost of $3.00/gallon, a base will spend roughly $3,000 per year on new motor oil, making the annual motor oil changing costs for this shop of $3,800. Use of an oil analyzer can potentially reduce annual oil change costs to just under $2,500 (assuming a 35 percent reduction in oil changes needed).

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Oil Analyzer	$750.00	$2,470.00	$3,800.00	$1,330.00	1

Exhibit 3-24. Pollution Prevention Opportunity Narrative: PPO No. IW-5

OPPORTUNITY NAME: Shop Rag Laundering

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: O&M

CURRENT PROCESS: Base shops use rags to clean up minor spills and to wipe down dirty parts and equipment. These rags are used until they become too dirty or soiled. The rags are collected in a waste drum and turned in as industrial waste. New rags are purchased to replace the discarded rags.

NEW PROCESS: All bases should participate in a rag laundering service. Most rag laundering service contracts include the removal of the used rags and replacement with newly laundered rags. The used rags are collected at each shop and can be serviced on a weekly, biweekly, or monthly basis, depending on the activity level in each shop. The used rags are cleaned at the laundering facility where they are stored for future use. Most laundering services only accept rags that are contaminated with POL products. Rags contaminated with solvents and other chemicals should be managed separately.

ENVIRONMENTAL BENEFIT: Use of a shop rag laundering service will reduce the disposal of waste rags by as much as 95%. If a typical base uses 30,000 shop rags annually, it could reduce industrial waste disposal by an estimated 3,000 pounds. The rags are laundered and reused instead of being collected for disposal in a landfill.

COST: The costs associated with using a rag laundering service are small when compared to the cost of purchasing new rags and disposing of the used rags. Most rag laundering services charge an average of $.08 per rag. This price includes the cost of delivery of the newly laundered rags and removal of the used ones. On average, a base will use 30,000 shop rags in a year. The cost for laundering 30,000 shop rags, at a cost of $.08 per rag, will be $2,400/year.

The costs associated with the purchase of new rags and the disposal of used rags will vary. On average, a base will pay as much as $.20 per rag for the entire process of purchase and disposal. A base that uses 30,000 rags will spend $6,000 annually for the purchase and disposal of its shop rags.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*
Rag Laundering	*$0.00*	*$2,400.00*	*$6,000.00*	*$3,600.00*	*0*

Exhibit 3-25. Pollution Prevention Opportunity Narrative: PPO No. IW-6

OPPORTUNITY NAME: Use of Rechargeable Batteries

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Conventional alkaline batteries are being used in many AFRC shops. The batteries are used in flashlights, beepers, various power tools, and emergency lights within C-130 aircraft. When the batteries run dead or do not supply sufficient power, they are collected in bins and disposed of as waste alkaline batteries. There are very few batteries currently in production that contain enough mercury to be considered a hazardous waste.

NEW PROCESS: The use of rechargeable batteries can significantly reduce alkaline battery disposal. For example, the Renewal battery, manufactured by Ray-o-Vac, is a long-lasting rechargeable alkaline battery which can be used in place of conventional batteries in most applications. By establishing routine recharging practices at the end of each workday, and recharging the batteries before they are fully drained, the batteries will last much longer than conventional alkaline batteries. According to the manufacturer, these batteries can be recharged up to 25 times. Although the initial charge capacity of the battery will be comparable to that of a conventional alkaline battery, each subsequent recharging will reduce its capacity. Rechargeable alkaline batteries generally have shelf-lives of more than five years. The Renewal batteries can be recharged only in a Renewal recharging unit, and charging in any other kind of charger is not advised.

ENVIRONMENTAL BENEFIT: The use of rechargeable alkaline batteries can reduce waste alkaline battery disposal by more than 75%. On average, a base that switches to rechargeable alkalines will reduce alkaline battery disposal by more than 750 pounds throughout the course of a year. When rechargeable batteries are replaced they must be managed in the same manner as conventional alkaline batteries. Most bases manage their waste alkaline batteries as industrial waste.

COST: The cost for the different types of batteries and the rechargers will vary slightly among vendors. According to Ray-O-Vac, a 4-pack of either AA or AAA batteries will cost $5.99; a 2-pack of either C or D batteries will cost $5.49; a Power Station I (which recharges four AA or AAA batteries) will cost $12; and a Power Station II (which recharges a combination of eight AAA, AA, C or D batteries), will cost $22. The energy costs for recharging the batteries are negligible.

If a base purchases 20 Power Station II rechargers, 500 AA/AAA batteries, and 500 C/D batteries, the total cost will be nearly $2,500. Over time, some of the rechargeables will have to be replaced and disposed of like regular alkalines. For the first year of use, there should be very few rechargeable batteries disposed. After that time, approximately 25% of the rechargeable batteries will have to be discarded each year due to their failure to hold an adequate charge. The

cost of disposing of the old batteries and purchasing new batteries will be approximately $500 each year.

Currently, non-rechargeable batteries are being disposed of at an average cost of $1.50 per pound. This cost is based on an average of base-specific disposal costs throughout the command. A typical base will generate 1,000 pounds of waste alkaline batteries in a year. This equates to an annual cost of almost $1,500 for disposal alone. The cost of purchasing new alkaline batteries will be an additional $1,500 per year. This equates to a total annual cost of over $3,000 for conventional alkaline battery use. The payback period for this opportunity is less than one year.

Option Name	Capitol Cost	Annual Costs (new)	Annual Costs (old)	Annual Cost/Savings	ROI (years)
Renewal Battery System	$2,500.00	$500.00	$3,000.00	$2,500.00	1

Exhibit 3-26. Pollution Prevention Opportunity Narrative: PPO No. IW-7

OPPORTUNITY NAME: Dryer for Fuel-Contaminated Absorbent

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Non-Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Absorbent used for cleaning up spills of fuel, oil, etc. is disposed of as hazardous, industrial, or municipal solid waste depending on the type material spilled.

NEW PROCESS: Contaminated absorbent is put in the dryer unit which draws air through the absorbent to remove the volatile organics and water in the absorbent. The air drawn through the absorbent is treated through a carbon filter before emission to the air. This PPO was developed by the Fuel Cell Repair Shop at Homestead ARS by constructing the dryer from vendor and shop parts. The dryer consists of a standard steel drum with holes punched at the bottom of the sides of the drum. Screening is put across the holes to keep in the absorbent and allow the air through. The top of a Tiger-Vac vacuum unit equipped with a carbon filter is attached to the top of the drum. The Tiger-Vac unit used by Homestead was model SS-55TC Single which cost about $5,000. The other parts were obtained in the shop for minimal cost. For more information, call Mike Johnson at the Homestead ARS Fuel Cell Repair Shop at (305) 224-7141.

This process should only be used with absorbent contaminated with fuels or water. Absorbent contaminated with oil does not work in the machine.

ENVIRONMENTAL BENEFIT: The new process allows absorbent to be reused two to three times. This saves the cost of new absorbent and disposal of contaminated absorbent which may be hazardous or require disposal as an industrial waste. Furthermore, absorbent that cannot be reused, is processed in the dryer to reduce its weight and to make it safe for disposal as a municipal solid waste.

COST: The capital cost of the dryer is essentially the Tiger-Vac unit which is about $5,000. The primary maintenance cost is for replacement of the carbon filter ($200) when it is spent. The replacement frequency is dependent on quantity and condition of contaminated absorbent treated in the dryer. The Homestead ARS fuel shop has not had to change the filter yet after seven months of use.

A typical fuel shop might use four drums of absorbents a year at a cost of about $1,000 for purchase of the new absorbent and disposal of the contaminated absorbent. The dryer could reduce the use and disposal of absorbents by up to 75% giving an annual saving of $750. If the carbon filter must be replaced every two years at an annual cost of $100, then the net savings are $650 per year. This gives a payback period for the capital cost of the dryer of 7.7 years.

Option Name	*Capitol Cost*	*Annual Costs (new)*	*Annual Costs (old)*	*Annual Cost/Savings*	*ROI (years)*

Dryer Unit	*$5,000.00*	*$350.00*	*$1,000.00*	*$0.00*	None

Exhibit 3-27. Pollution Prevention Opportunity Narrative: PPO No. IW-8

OPPORTUNITY NAME: Microbial Breakdown of Petroleum Products

PRIMARY PROGRAM AREA: Industrial Waste

FUNDING REQUIREMENTS: Recurring

FUND APPROPRIATION: Pollution Prevention

CURRENT PROCESS: Spills of oil, fuel, and other petroleum products are either cleaned-up with absorbent pads, steam cleaned, or washed to an oil/water separator; if not cleaned-up, they can discharge to surface waters or soils. If the spill reaches the ground, the soil is either removed for disposal, treated, or left to naturally attenuate.

NEW PROCESS: There are three major types of microbial-based products available for cleaning and breaking down petroleum. The first is a liquid floor cleaner (called "Microbial Petroleum Formula" by the vendor listed below) that is used for cleaning floors. The cleaner is mixed one ounce to one gallon of water and is used to clean oils and fuels from floors. The cleaner can be washed down floor drains to an oil/water separator where the cleaner's microbes breakdown the petroleum products that have accumulated on the

1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES

This Pollution Prevention Opportunity Assessment (PPOA) is a major component of the Air Force Reserve Command (AFRC) Pollution Prevention Program and Pollution Prevention Strategic Plan (PPSP). The PPOA focuses on evaluating pollution prevention opportunities and assessing each opportunity for validity and effectiveness. This effort assesses all pollutant sources and examines material usage and waste generation by type and volume, and determines the most practical and economical options for pollution prevention. This generally involves examining each process involving a targeted substance to determine ways to avoid use or generation of that substance.

The primary objective of the PPOA is to identify Pollution Prevention Opportunities (PPOs) that may be needed to achieve USAF pollution prevention goals. These PPOs are evaluated for technical, environmental, and economic feasibility. The PPOA emphasizes projects, material substitutions, equipment purchases, and/or process changes that will reduce an installation's major waste streams or hazardous materials (HAZMAT) usage and aid bases in meeting their pollution prevention goals.

Complementing the information in the PPOA is a PPO database that is essentially the universe of all PPOs that can be implemented at AFRC bases. This computerized database will serve the bases by providing detailed information about existing and recommended PPOs. This PPO database and other information in the PPOA are used in the Strategic Plan to assist AFRC bases in meeting or exceeding USAF pollution prevention goals and reducing compliance costs and problems.

1.2 TECHNICAL APPROACH

The basic approach for preparing the PPOA was to collect key data from each AFRC base and to identify effective PPOs that would allow bases to achieve short- and long-term pollution prevention goals. The technical approach conducted to prepare this PPOA consisted of the following major efforts:

1. Reviewed numerous pollution prevention and related documents and plans to obtain important data on each base.

2. Visited all AFRC bases and obtained key information from interviews with shop and other base personnel to assess the status of the pollution prevention program at each base.

3. Prepared initial comprehensive lists of PPOs potentially feasible for the different pollution prevention program areas. The PPOs in these lists were then evaluated during the pollution prevention surveys to determine which PPOs should be subjected to further analysis.

4. Identified additional PPOs for consideration through research and interviews with base personnel.

5. Performed analysis of PPOs screened during the survey to identify PPOs that are technically, environmentally, and economically feasible.

6. Prepared a list of feasible PPOs available for implementation by base personnel.

Throughout these efforts, various personnel from each base were contacted for input and feedback including civil engineering environmental (CEV), the bioenvironmental engineer (SGPB), and shop personnel. Personnel were contacted to discuss past and current pollution prevention techniques that have been implemented. For those PPOs that have been recommended, input and feedback were solicited from base personnel to facilitate future implementation through participation in the planning process.

As a result of the solicitation of information and ideas by SEA and subsequent input and feedback from base personnel, this PPOA provides a list of PPOs that:

- Allow the bases to attain or exceed the USAF pollution prevention goals
- Are technically, environmentally, and economically feasible for most of the bases

- Are acceptable for implementation by many of the shops and base personnel.

1.3 REPORT CONTENT

The PPOA contains three sections. Section 1.0 is this introduction. Section 2.0, Pollution Prevention Opportunity Evaluation Process, provides a description of the process used by SEA in evaluating and screening the PPOs that are appropriate for AFRC bases. This section provides a list of all PPOs that are feasible for use at AFRC bases.

Section 3.0, Detailed Information on Recommended PPOs, provides a detailed description for each PPO that has been identified in Section 2.0 as feasible for use at AFRC bases.

2.0 POLLUTION PREVENTION OPPORTUNITY EVALUATION PROCESS

This section describes the process used by SEA for evaluating and screening the PPOs that are appropriate for AFRC bases. Subsection 2.1, Initial Consideration of PPOs and Screening Process, describes the process for screening the extensive list of possible PPOs down to a list that is technically, environmentally, and economically feasible.

Subsection 2.2, Collection and Exchange of PPO Information, discusses the methodology used during the pollution prevention surveys to collect and exchange key information for the PPOA and PPSP. Subsection 2.3, Research of PPOs, describes the research activities conducted to obtain further information on PPOs. Finally, Subsection 2.4, Final PPO List, provides a table that lists the PPOs that are feasible for implementation at the bases.

2.1 INITIAL CONSIDERATION OF PPOS AND SCREENING PROCESS

Determining the appropriate PPOs for use at AFRC bases is a step-wise process that involves evaluating and screening potential PPOs to develop a PPO list best suited to the operations and needs of AFRC bases.

The process begins with development of a comprehensive list of PPOs that might be applicable to the bases. This list was developed from prior experience and various documents including Air Force Model Shop Reports, DOD documents and on-line services, prior pollution prevention plans for AFRC bases, and EPA guidance and informational documents.

The list of PPOs was used by SEA during the site visits as a reference to develop PPOs for each shop. Upon examination of each shop, the PPOs that might be appropriate were selected and "bounced off" shop personnel for feedback and acceptability. Many potential PPOs on the comprehensive list were deemed to be inappropriate after inspection of the shops. Other suggested PPOs were also eliminated from further consideration, because the shop personnel had already tried or considered implementing the PPOs and determined them not to be feasible. Subsection 2.2 below describes the collection and exchange of PPO information during the site visits.

At the time of the site visits, some shop personnel were developing and evaluating PPOs for their own shops. These PPOs were also added to the list and were examined by SEA for further analysis. In addition, after site visits, other PPOs were added to the list in an effort to address a particular waste stream, HAZMAT, or other pollution prevention issue. These PPOs were added based on research by SEA.

The initial list of PPOs was then subjected to analysis by SEA engineers and scientists to determine which PPOs are technically, environmentally, and economically feasible for implementation at AFRC bases. Technically feasible means:

- The PPO technology is proven and commercially available.
- Applicable USAF Technical Orders (TOs) will not be usurped by the PPO.

- Quality will not be compromised.
- The engineering aspects of the PPO will allow for successful implementation.
- The PPO is acceptable to shop personnel.

Environmentally feasible means:

- All affected environmental requirements will be complied with.
- The PPO will help the base meet or exceed pollution prevention goals.
- The environment will benefit following implementation of the PPO.
- Base personnel will not be subjected to unsafe conditions.

Economically feasible means the PPO does not have an exorbitantly high capital cost and has a reasonable payback period. The term reasonable is used because PPOs with a long or even no payback period may still be reasonable if the PPO contributes significantly to meeting pollution prevention goals. In other words, the benefits exceed the cost.

Finally, this screening process produced a list of PPOs appropriate for some or all of the bases. This list of PPOs and associated information was then put into the database. Where more information was needed for a PPO, further research was conducted by SEA to complete the entries in the database. These research efforts are briefly described in Subsection 2.3 below.

A table of the final list of PPOs in the database is provided in Subsection 2.4. A description of each of the PPOs is provided in Section 3.0.

2.2 COLLECTION AND EXCHANGE OF PPO INFORMATION

This subsection discusses the methodology used during the pollution prevention site surveys to collect key information on past, existing, and planned PPOs, as well as on PPOs that might be recommended. This methodology included exchanging information about PPOs between each base using SEA personnel as intermediaries.

The pollution prevention surveys consisted of a review of documents and plans, shop visits and interviews of personnel at each of the bases. The surveys were conducted at 10 AFRC bases spanning several months from September 1997 to March 1998. In addition, the eleventh base, Niagara Falls ARS, was surveyed and visited in October 1996 under a separate project. Table 2-1 provides a list of the bases surveyed and the dates of each site visit.

Table 2-1. Pollution Prevention Site Survey Dates for Each AFRC Base

BASE	DATE SURVEYED
DOB	January 12-16, 1998
GMT	October 14-17, 1997
GRI	September 29-October 3, 1997
HOM	January 26-30, 1998
MAR	December 8-12, 1997
MSP	September 8-12, 1997
NFS	October 21-25, 1996
PIT	November 17-21, 1997
WST	March 2-6, 1998
WIL	February 23-27, 1998
YNG	October 20-24, 1997

The shops at each of the bases were visited by SEA to obtain the following information:

- Descriptions of shop activities and hazardous material usage and waste generation
- Descriptions of current pollution prevention equipment and projects
- Analysis and acceptance of current pollution prevention equipment by base personnel
- Descriptions of innovative and successful PPOs which could help other bases
- Need for additional PPOs
- Potential for PPOs suggested by SEA to be implemented.

In addition to obtaining important information from the base for the PPOA and PPSP, the site visits proved to be very successful in exchanging information on PPOs and related experiences between shop and environmental personnel at different bases. During the base visits, there were numerous cases where a pollution prevention problem noted at one or more bases was addressed by an innovative PPO at another base. This exchange of information, with SEA personnel as intermediaries, proved to be a tremendous source of recommended PPOs for AFRC bases.

2.3 RESEARCH OF PPOS

After preparing the list of PPOs appropriate for AFRC bases, further information was needed for many PPOs to complete the data fields in the database. Such information