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ENVIRONMENTAL RESEARCH BRIEF

Waste Reduction Activities and Options for an Electrical Utility Transmission System Monitoring and Maintenance Facility

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Abstract

The U.S. Environmental Protection Agency (EPA) funded a project with the New Jersey Department of Environmental Protection and Energy (NJDEPE) to assist in conducting waste minimization assessments at 30 small- to medium-sized businesses in the state of New Jersey. One of the sites selected was an electrical utility transmission system monitoring and maintenance facility which has the responsibility to monitor, maintain, and repair the distribution system for the electrical service provided in a defined geographical area by a regulated public utility. A site visit was made in 1990 during which several opportunities for waste minimization were identified. Options identified for waste reduction included more accessible inventory records to identify PCB-containing transformers, changing procedures for vehicle oil changes, a search for alternatives for electrical connection degreasing, and change to low-solvent or water-based coatings for transformer reconditioning. Implementation of the identified waste minimization opportunities was not part of the program. Percent waste reduction, net annual savings, implementation costs and payback periods were estimated.

This Research Brief was developed by the Principal Investigators and EPA's Risk Reduction Engineering Laboratory in Cincinnati, OH, to announce key findings of this completed assessment.

Introduction

The environmental issues facing industry today have expanded considerably beyond traditional concerns. Wastewater, air emissions, potential soil and groundwater contamination, solid waste disposal, and employee health and safety have become increasingly important concerns. The management and disposal of hazardous substances, including both process-related wastes and residues from waste treatment, receive significant attention because of regulation and economics.

As environmental issues have become more complex, the strategies for waste management and control have become more systematic and integrated. The positive role of waste minimization and pollution prevention within industrial operations at each stage of product life is recognized throughout the world. An ideal goal is to manufacture products while generating the least amount of waste possible.

The Hazardous Waste Advisement Program (HWAP) of the Division of Hazardous Waste Management, NJDEPE, is pursuing the goals of waste minimization awareness and program implementation in the state. HWAP, with the help of an EPA grant from the Risk Reduction Engineering Laboratory, conducted an Assessment of Reduction and Recycling Opportunities for Hazardous Waste (ARROW) project. ARROW was designed to assess waste minimization potential across a broad range of New Jersey industries. The project targeted 30 sites to perform waste minimization assessments following the approach outlined in EPA's *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003). Under contract to NJDEPE, the Hazardous Substance Management Research Center at the New Jersey Institute of Technology (NJIT) assisted in conducting the assessments. This research brief presents an assessment of a monitoring and maintenance facility for an electrical utility transmission system (1 of the 30 assessments performed) and provides recommendations for waste minimization options resulting from the assessment.

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Methodology of Assessments

The assessment process was coordinated by a team of technical staff from NJIT with experience in process operations, basic chemistry, and environmental concerns and needs. Because the EPA waste minimization manual is designed to be primarily applied by the inhouse staff of the facility, the degree of involvement of the NJIT team varied according to the ease with which the facility staff could apply the manual. In some cases, NJIT's role was to provide advice. In others, NJIT conducted essentially the entire evaluation.

The goal of the project was to encourage participation in the assessment process by management and staff at the facility. To do this, the participants were encouraged to proceed through the organizational steps outlined in the manual. These steps can be summarized as follows:

- Obtaining corporate commitment to a waste minimization initiative
- Organizing a task force or similar group to carry out the assessment
- Developing a policy statement regarding waste minimization for issuance by corporate management
- Establishing tentative waste reduction goals to be achieved by the program
- Identifying waste-generating sites and processes
- Conducting a detailed site inspection
- Developing a list of options which may lead to the waste reduction goal
- Formally analyzing the feasibility of the various options
- Measuring the effectiveness of the options and continuing the assessment.

Not every facility was able to follow these steps as presented. In each case, however, the identification of waste-generating sites and processes, detailed site inspections, and development of options was carried out. Frequently, it was necessary for a high degree of involvement by NJIT to accomplish these steps. Two common reasons for needing outside participation were a shortage of technical staff within the company and a need to develop an agenda for technical action before corporate commitment and policy statements could be obtained.

It was not a goal of the ARROW project to participate in the feasibility analysis or implementation steps. However, NJIT offered to provide advice for feasibility analysis if requested.

In each case, the NJIT team made several site visits to the facility. Initially, visits were made to explain the EPA manual and to encourage the facility through the organizational stages. If delays and complications developed, the team offered assistance in the technical review, inspections, and option development.

No sampling or laboratory analysis was undertaken as part of these assessments.

Facility Background

The facility has the responsibility to monitor, maintain, and repair the distribution system for the electrical service provided in a defined geographical area by a regulated public utility. Included among the functions of the facility are response to accidents involving company equipment, service to a fleet of vehicles, and repair, maintenance, and rebuilding of transformers. The facility studied is only one of several operated by the company throughout its service area.

Operational Processes

Conceptually, the industrial activities at this facility are relatively simple. Company staff respond to accidents which may involve damaged utility poles and broken transformers. They also have responsibility for regular inspection and maintenance of distribution lines and ancillary equipment. Maintenance and repair of a fleet of vehicles used in this operation is also carried out at the facility. Finally, repair, reconditioning, and rebuilding of transformers and similar equipment is a regular operation of this facility.

The response to accidents involves emergency repair and replacement of equipment in the field and may involve clean up of leaking transformer oil of which some may contain PCB's. This clean up activity may result in substantial quantities of waste, not only of oil which must be drained from damaged transformers, but also from soil or other materials which may have been contaminated with the oil.

The reconditioning operation for the transformers involves draining the oil, repairing any damaged components, painting them, filling them with fresh mineral oil, and putting them back into service. The painting operation currently uses aerosol cans of solvent-based paints.

In the process of reinstalling the electrical equipment within the system, it is a standard practice to clean the electrical connections with a solvent, usually 1,1,1-trichloroethane, to promote good contact by removal of any grease.

The vehicle maintenance activities carried out at the facility include fluid changes (resulting in waste streams of oil, antifreeze, and freon) and metal part repair and replacement.

Existing Waste Management Activities

The company has already recognized some advantages and benefits of identifying and implementing waste reduction and pollution prevention practices. A study was done which indicated that the time between vehicle oil changes could be lengthened without adversely affecting the operation of the engines. Such a change would reduce the volume of waste oil generated at the facility. The company has plans to acquire a recovery and recycling unit for the freon used in vehicle air conditioning systems. Scrap metals recovered as part of the operations of the facility are sent out for secondary recovery and not disposed of as waste.

The company has taken a conservative position with regard to transformer oil by making the initial assumption that all such oil, particularly that appearing as leaks or spills, should be treated as if it contained PCB's. Tests are done subsequently to confirm this assumption. Consequently, a significant volume of waste is initially listed as PCB-containing and later reclassified.

Other waste streams are sent for treatment and management offsite.

Waste Minimization Opportunities

The type of waste currently generated by the facility, the source of the waste, the quantity of the waste and the annual treatment and disposal costs are given in Table 1.

Table 2 shows the opportunities for waste minimization recommended for the facility. The type of waste, the minimization opportunity, the possible waste reduction and associated savings, and the implementation cost along with the payback time are given in the table. The quantities of waste currently generated at the facility and possible waste reduction depend on the level of activity of the facility.

It should be noted that the economic savings of the minimization opportunity, in most cases, results from the need for less raw material and from reduced present and future costs associated with waste treatment and disposal. It should also be noted that the savings given for each opportunity reflect the savings achievable when implementing each waste minimization opportunity independently and do not reflect savings that would result when the opportunities are implemented in a package. Also, no equipment depreciation is factored into the calculations.

The largest volume of waste from this facility is related to clean up activities over which the facility has no direct control. A long range answer is to improve the durability of equipment, specifically in the case of transformers, to decrease the likelihood of leakage as a result of accidents and aging. An additional facet of this situation is the desire of the company to avoid any negative perception of contamination problems, and therefore it is taking a very conservative position regarding clean up and management of spill situations. While such a position is in many ways laudable and understandable, it does add to the waste management quantity when material is treated as hazardous waste when other options may be available, such as easy identification and location of hazardous materials through a tracking system.

Regulatory Implications

Changes in reconditioning of electrical equipment may have regulatory implications. There are penalties incurred by the company for service disruptions. When a particular method has been shown by experience to be satisfactory in maintaining an acceptable level of customer service, there is a reluctance to make changes without a clear determination of superiority or at least of comparability. Therefore, some of the options identified in this assessment will require evaluation and field trials before adoption.

This Research Brief summarizes a part of the work done under cooperative Agreement No. CR-815165 by the New Jersey Institute of Technology under the sponsorship of the New Jersey Department of Environmental Protection and Energy and the U.S. Environmental Protection Agency. The EPA Project Officer was Mary Ann Curran. She can be reached at:

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* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Table 1. *Summary of Current Waste Generation*

Waste Generated	*Source of Waste*	*Annual Quantity Generated*	*Annual Waste Management Costs*
Oil Spill and Leak Residue	*Primarily damage to transformers*	*155 Tons*	*$46,000*
Waste Oil from Electrical Transformers	*Draining of oil prior to reconditioning or decommissioning transformers*	*126 Tons*	*100,000*
Wastes Containing PCB	*Primarily damage to transformers and PCB recovery*	*28 Tons*	*50,000*
Motor Vehicle Oil	*Vehicle maintenance and repair*	*2.7 Tons*	*400*
Painting Residue	*Transformer casing painting*	*1 Ton*	*2000*

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Table 2. *Summary of Recommended Waste Minimization Opportunities*

Waste Stream Reduced	Minimization Opportunity	Annual Waste Reduction Quantity	Annual Waste Reduction Percent	Net Annual Savings	Implementation Cost	Payback Years *
Wastes Containing PCB	*Improved access to information about the PCB content of individual transformers. A computerized system of record keeping is suggested.*	*21 tons*	*75*	*$30,000*	*$20,000*	*0.67*
(It should be noted that this does not represent a net reduction of waste. It merely moves a portion of a waste stream from one type of hazard category to another less hazardous category.)						
Motor Vehicle Oil	*Change frequency of oil changes from 6000 mile to 7500 mile intervals.*	*0.7 tons*	*25*	*100*	*0*	-
Painting Residue	*Change from solvent-based aerosol paint to brushed-on water-based paint.*	*0.9 tons*	*90*	*1800*	*300*	*0.16*
(It should be noted that this depends upon the availability of a water-based coating with the necessary performance characteristics. It also ignores the extra worker time needed to apply coatings by brushing as well as the possibility that coatings will have to be applied more regularly.)						
Residues from Transformer Leaks and Repairs	*Modify design and construction of transformers to reduce damage and subsequent leaks and spills.*	*140 tons*	*50*	*70,000*	*unknown*	*unknown*
(It should be noted that this option will require substantial additional research by transformer manufacturers into why transformers fail and whether and what changes can be made to improve their performance. Such research and design changes are beyond the present technical scope of the company. Therefore only an approximation can be made. Certainly, because this is the largest waste category at the facility, effort should be made to identify options.)						
Chlorinated Solvent from Electrical Contact Degreasing	*Change to non-chlorinated solvent.*	*10 gal*	*100*	*none*	*none*	
(It should be noted that this option would have no effect on wastes manifested from the facility. Rather it changes the category of use of a relatively toxic material to one which is less toxic. The total quantity of volatile material emitted to the air may stay the same or in fact may increase. Without tests of performance it will not be possible to determine the amount to be used. It is often the case in substitution situations of this type that employee perception plays a significant role in the quantity of material to be used. If the worker believes that the performance of the substitute is not as good as that of the original material, then more of the material will be used.)						

* Savings result from reduced raw material and treatment and disposal costs when implementing each minimization opportunity independently.

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