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EPA ENVIRONMENTAL RESEARCH BRIEF

Waste Reduction Activities and Options for a Nuclear Powered Electrical Generating Station

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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 a nuclear powered electrical generating station. A site visit was made in 1990 during which several opportunities for waste minimization were identified. The assessment identified waste oil and oil/water mixtures, coatings, solvents, grease, and laboratory reagents as significant contributors to the facility's waste stream. Options identified for waste reduction included strengthened inventory controls, encouragement of "just-in-time" delivery of supplies, direct charge back of waste treatment expenses to the unit or project responsible for the waste, encouragement of the use of materials with reduced hazard level, and change of the frequency or material used for coating of surfaces. 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.

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.

* 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 assignment.

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 nuclear powered electrical generating station (1 of the 30 assessments performed) and Provides recommendations for waste minimization options resulting from the assessment.

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 in-house 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.

Nuclear Powered Generating Facility

At this facility, there was enthusiasm for the assessment both on the part of the technical staff and on the part of the management. The pollution prevention team had been formed prior to the arrival of the NJIT team and most of the gathering of data was carried out by the team at the facility. The development of options for additional pollution prevention was done jointly by the group from the facility and the personnel from NJIT.

At this facility, electrical energy is produced by a nuclear generator. This type of facility presents an unusual subject for a waste reduction study. The product of the facility is energy. Hazardous wastes are generated predominantly during the times when power generation is not in operation. (Radioactive wastes are not included in this study.) Moreover, it is apparent from the results of the assessment that the bulk of the hazardous waste from the facility is produced from construction and maintenance activities largely when the energy generation activity is in an outage.

Manufacturing Process

This facility produces electrical energy by a process which depends upon heating water by a nuclear source. The operation of the facility results in the formation of radioactive waste which is managed according to the appropriate federal regulations. The high costs of waste management for this type of waste has encouraged significant waste reduction efforts in this area throughout the industry. The focus of this assessment (non-radioactive waste) has similarly benefited from waste reduction efforts, although the assessment has identified additional options which could be implemented. Three departmental operations have been found to be associated with the generation of waste: Maintenance, Site Services, and Operations. In addition, a significant source of waste for disposal is off-specification and partially used materials which are not easily associated with any specific operation or job process.

Major waste streams identified were:

- Oil and Oil/Water Mixtures
- Coatings (Paints, Epoxy, Enamels)
- Solvents
- Grease
- Laboratory Reagents

Much of the waste oil stream results from a remediation project at the site and not directly from the operation of the facility. The other materials result frequently from regular equipment and facility repair and upgrade activities. Significant quantities of off-specification and partially used containers of materials are presented for waste management or disposal.

Existing Waste Management Activities

The facility has implemented several effective steps to reduce waste generation at the facility including:

- Making surplus materials available to employees for their personal use.
- Selling surplus materials to commercial users.
- Improving ordering and warehouse procedures to reduce overstocking and surplus materials.
- Innovative material handling procedures such as purchasing materials in large containers and dispensing them in "just the right amount" containers.

The waste streams that are generated are sent offsite for disposal.

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 (where known and available) are given in Table 1.

Table 2 presents the opportunities for pollution prevention which were identified during the assessment. The type of waste, the minimization opportunity, and the possible waste reductions, are presented in the table. When available or estimable, the associated saving, and implementation costs along with payback times are also give. However, because the feasibility analysis was to be carried out by the staff of the facility, that information is not always readily available.

Table 1. Summary of Generated Wastes

Waste Generated	Source of Waste	Annual Quantity Generated	Annual Costs
Oil, Oil/Water and Oily Soil	Equipment oil change Oil spill cleanup Remediation activities	10,000 gal	$2,000
Coatings (Paint, Epoxy, Enamels)	Surface Repair and maintenance	1,200 gal	$4,800
Solvents	Degreasing, paint thinning	1,400 lb	$2,100
Grease	Maintenance of machinery	50 gal	$ 400
Laboratory Reagents	Water quality tests	2 drums	$600
Surplus Materials	Outdated and off-specification supplies usually from the warehouse	90 drums	$27,000

Table 2. Summary of Waste Minimization Options Identified

Waste Generated	Minimization Opportunity	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Payback Years
		Quantity	Percent			
Oil and Oil/Water Mixtures	Implement procedures to minimize oil spills and leaks. Review equipment specifications to determine if frequency of oil changes is appropriate. Consider improved oil/water separation technology.	2000 gal	20%	$8400	$1600	0.2
Coatings	Consider specifying coatings with reduced hazard levels compared with present materials. Reconsider the frequency of application of coatings. Encourage use of water-based coatings rather than solvent-based versions. Investigate alternative uses for surplus coatings such as parking lot striping.	600 gal	50%	$3600	-0-	immed
Solvents	Consider use of aqueous surfactant solutions rather than solvents for cleaning. Use of water-based paints will reduce need for thinners.	200 lb	14%	$294	$1,200	4.0
Surplus and Off-spec Materials	Identify alternative beneficial uses for out-of-date materials. Make surplus materials available to other company owned facilities. Purchase appropriately sized containers of materials. Determine whether materials discarded during clean-ups are truly waste and revise procedures appropriately. Review shelf life dates for possible extension.	22 drums	25%	$5,400	$15,000	3.0

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Additional Options Identified

In addition to the options previously discussed other options were suggested. It was observed that occasionally containers of hazardous waste are found on the site away from the active secured sections which cannot be identified according to source. It is presumed that these materials are discarded by contractors or other non-employees. It is suggested, therefore, that vehicles entering the facility be examined to assure that they do not leave such containers at the site.

A clear correlation was observed between the amount of full containers and usable materials presented for waste disposal and the scheduled inspections of the facility. It is postulated that such materials are discarded in order to demonstrate a neater appearance to the inspection team. Alternate storage arrangements for such situations should be developed.

Regulatory Implications

There seem to be no regulatory issues which would impede the implementation of additional pollution prevention initiatives at this facility. The staff and management of the facility are well informed about environmental and radioactivity-related regulations. However, it should be well recognized that because nuclear regulators have great influence over the operation of this type of facility, if any pollution prevention option entails any sort of risk which may cause difficulty with fulfilling a nuclear regulation, the pollution prevention option will not be implemented. This is an example of potentially conflicting jurisdictions which may inhibit changes in industrial behavior. Situations such as this raise the need for coordination of all regulations if pollution prevention is to become efficient and effective throughout the industrial world.

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