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ENVIRONMENTAL RESEARCH BRIEF

Waste Reduction Activities and Options for a Manufacturer of Room Air Conditioning Units and Humidifiers

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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 facility that manufactures room air conditioners and humidifiers. A site visit was made in 1990 during which several opportunities for waste minimization were identified. These opportunities include more efficient recovery of degreasing solvents, movement to aqueous degreasing procedures, and segregation and reuse of hydraulic and lubricating fluids. 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.

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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 room air conditioner and humidifier manufacturer (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 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.

The Paint Manufacturer

The facility is a producer of paints, used primarily in the metal finishing industry including automobile refinishing applications. This business requires production of a large variety of colors and finish types, most in relatively small quantities. The specifications of their customers allow a very narrow range of variation in color and appearance of the finished product. This severely limits the flexibility the company has in changing production processes.

The production of the various types of paints is conceptually very simple. Required operations include mixing and blending (under carefully specified conditions) raw materials either purchased from vendors or shipped from other company sites. No manufacturing of paint constituents takes place at this facility. After formulation and blending, the paints are transferred to a variety of containers for shipment to the customer. The processing equipment is cleaned prior to preparation of the next batch. The cleaning operation typically includes multiple rinses with solvent in order to remove the pigments and additives remaining from the previous batch.

Paint production uses a solvent or liquid carrier to dissolve or suspend the components of the coating system. This process is a large user of solvents. At present, the preponderance of the solvents used in these applications are organic. However, there is a trend In the coatings industry toward water-based products where customer demands and product performance criteria are met. The technology for water-based coatings has not been sufficiently advanced to address all such demands and performance requirements. Therefore, solvent-based paints and coatings will be required for some time.

The company has already instituted a program of pollution prevention. This is perhaps best illustrated by the acquisition and use of a large capacity still which allows recovery and reuse of the solvents from the equipment washing operations. Other pollution prevention efforts have been carried out in conjunction with the corporate research and development group. This lead to the reduction or elimination of the use of heavy metal-containing dyes and pigments in products produced by this facility.

Waste Streams and Existing Waste Management

This particular facility presents a challenge in describing waste streams. The presence of an operating solvent recovery system means that the actual waste streams sent offsite are relatively insignificant in terms of the total effluent from the process before the solvent distillation. Moreover, where there is a significant level of air emissions to be addressed, the meaning of the term "treatment and disposal costs" has to be strained to include simple loss of the value of materials.

The major RCRA waste from this facility is the still bottoms from the recovery/recycling/reuse of waste solvents from the equipment washing process. About 250 drums of this material are produced annually from the facility and are sent offsite for disposal. This quantity represents 10% to 20 % of the volume of waste solvents which were sent for disposal prior to the installation of the distillation equipment.

Another waste stream results from quality control samples of finished batches which are retained at the facility for a period of time for examination if customer problems or complaints come in about specific batches of paint. After the retention period, the samples are discarded as hazardous waste. Approximately one quart size samples are collected and retained. The typical current practice is to recover the solvent from these retained samples through the solvent recovery system. There was no information available on the number of these samples generated and retained each year.

Another waste stream identified was a waste oil stream from equipment maintenance and repair. This stream averages 3 to 4 drums per year and is sent offsite for recycling and recovery.

The greatest pollution prevention challenge at this facility is not RCRA-type waste streams. Rather it consists of stack emissions and fugitive air emissions. SARA Title III reporting and additional estimates indicated that approximately 200,000 lb of solvent are emitted to the atmosphere annually. The facility intends to address this situation using a pollution prevention approach.

on the level of activity of the facility. All values should be considered in that context.

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 duplication of savings that would result when the opportunities are implemented in a package. Also, no equipment depreciation is factored into the calculations.

The most beneficial option from the perspective of risk reduction would be acceleration of the program to replace the final vapor degreasing unit with another aqueous based cleaner. It is recognized that there are some concerns about the space available for such a substitute unit, as well as some concerns about the effect of the change on rate of production at the facility. It should be recognized that the vapor degreasing unit is being used because it is effective and rapid as a cleaner. Substitute units often are somewhat less efficient meaning that throughput may be reduced. This is sometimes a significant manufacturing concern. It is suggested that a manufacturing time/motion/layout study be carried out to address some of these concerns.

In the meantime, while the solvent vapor degreaser is still in operation, it is likely that a portion of the fugitive emissions result from the following: less than optimum cooling/condensation of the vapor, the ventilation capture velocity may not be functioning adequately, or the water/trichloroethylene separator may not be operating as effectively as it should. Attention to these operational parameters may impact the amount of loss of the solvent.

At present the leaked hydraulic oil is mixed with the other machining and lubricating waste oils and hauled away as hazardous waste. Capture of the leaked hydraulic oil is suggested. The material may be acceptable for reuse if it is not allowed to become contaminated with other materials. If not reusable immediately, it may be possible to recondition it either mechanically onsite or by use of a commercial reconditioning service.

It is possible that some of the oil/grease from the coil cleaning operation in alkaline aqueous media is not completely separated by the oil separator due to the formation of oil in water emulsions. It is suggested that polymeric emulsion breakers be tried in order to improve the performance of this unit. It should be realized that this option would not be expected to result in any savings for the facility. Rather it would result, if effective, in a cleaner aqueous stream.

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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Table 1. *Summary of Current Waste Generation*

Waste Generated	*Source of Waste*	*Annual Quantity Generated*	*Annual Costs*
Waste Oils	*Mixed hydraulic, lubricating*	*40,000 gal*	*$80,000*
Wastewater	*Discharged water from aqueous degreasers*	*200,000 gal*	*$82*
Chlorinated Solvent/ Sludge	*Spent solvent from degreasers*	*27,000 lb*	*$12,800*
Spent Activated Carbon	*Filters from vapor degreaser*	*120 lb*	*$350*
Solvent Loss	*Fugitive emissions from degreaser*	*>2,000 lb*	*>$1,300*

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Table 2. *Summary of Waste Minimization Opportunities*

Waste Stream Reduced	Minimization Opportunity	Annual Waste Reduction Quantity	Annual Waste Reduction Percent	Net Annual Savings	Implementation Cost	Payback Years*
Waste Oils	*Collect and segregate hydraulic oil leaks, check quality, if acceptable, reuse, or purify by filtration, centrifugation, or use of outside, reconditioning service*	*5000 gal*	*12%*	*$ 12,500*	*$4,000*	*0.3*
Chlorinated Solvent/ Sludge, Spent Activated Carbon, Solvent Loss	*Complete change to aqueous alkaline degreasing operation.*	*30,000 lb*	*100%*	*$14,050* (It must be realized that this option will increase the quantity of water sent to the POTW and will increase the amount of waste oil recovered from the oil separator.)	*$30,000*	*2.0*
Solvent Loss	*Improve mechanical performance of the solvent capture system*	*600 lb*	*30%*	*$400* (This represents regular maintenance which will be incurred annually, therefore, any payback period based on implementation costs, may be illusory.)	*$500*	*1.2*

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

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