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ENVIRONMENTAL RESEARCH BRIEF

Waste Reduction Activities and Options for a Transporter of Bulk Plastic Pellets

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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 trucking company which specializes in the transportation of dry bulk plastic pellets from the manufacturer to the user. The assessment focused on the large volumes of hot water which are used to clean the tank trucks between shipments. A site visit was made in 1990 during which several opportunities for waste minimization were identified. Options identified included recirculation of the water and use of compressed gasses as a partial replacement for the water stream used to clean the trucks. 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, New Jersey Department of Environmental Protection and Energy, 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 New Jersey Institute of Technology (NJIT) assisted in conducting the assessments. This research brief presents an assessment of the transportation of dry plastic pellets from the manufacturer to the user (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,

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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.

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

Facility Background

The facility is the home base of a medium sized trucking-transportation company, which specializes in transporting dry, bulk plastic pellets of several types including polypropylene, polyvinyl chloride, and polystyrene. The company is responsible for the movement of the pellets from the plastic manufacturer to their customers. The economics of manufacture and of the use of large quantities of the pellets favor such bulk transportation. There are significant quality issues which require segregation of different types and composition of pellets, contamination may result in inferior quality of products by the user of the pellets. The transportation company then must scrupulously clean the tankers between each load. It was reported that some customers will refuse a shipment if a single foreign pellet is observed.

At this facility, other activities including vehicle maintenance occur. The waste reduction opportunities assessment was carried out only on the plastic pellet handling and cleaning section of the facility at the request of the management. There was very little input received from the management. The identification of options and of necessary additional information was carried out by the assessment team.

The facility houses administrative buildings, a 2-bay maintenance garage, parking areas, and the tank cleaning operation. The site is bordered by a small stream. About 200 people are employed at the rural location.

Operational Processes

The process of cleaning the trucks' tanks involves use of filtered water from a 250-ft deep well which is on the property. The water is heated in a Karcher unit and sprayed through a revolving head. The head is lowered into the body of the tank through the port on the top. Multiple nozzles on the head are designed to assure that the water streams are directed at all areas of the truck interior. The water exits the tank, carrying the pellets, through a 4-in. drain at the rear of the tank. The drain is fitted with a "sock-like" bag filter to capture the pellets which are removed from the truck by this procedure. The capture pellets are recovered, segregated by type, and returned to the manufacturer or sold to brokers for reuse. On average 2 or 3 tank trucks are cleaned by this process each day. Average daily water use is about 10,000 gal. About 5 gal of pellets are recovered each day.

Existing Waste Management Activities

From a broad industry-wide perspective it seems that activities of this company are supportive of many commonly encouraged principles of pollution prevention. Shipment of materials in bulk eliminates the need for packaging materials and eliminates substantial quantities of waste. Careful attention to product quality and prevention of cross contamination of materials is critical to minimize product and process failures by the ultimate manufacturer. Such failures also contribute to the waste stream. This facility takes care to recover and return to the manufacturing stream the excess pellets which would otherwise contaminate other materials or be discarded as waste. This tank cleaning activity illustrates a less commonly recognized principle—that many pollution prevention benefits require action by someone in the raw material/transportation/production chain which results in a waste stream.

The rinse water is collected in a sump after passing through the bag filter at the exit port of the tank. The sump has a float which triggers a pump to move the collected water to a storm water catch basin in a paved area. This water, as well as storm water runoff, is drained into a pair of underground settling tanks. The outflow of these tanks enters a stream which borders the property. Periodically (approximately once each year), the settling tanks are cleaned and any solid residue is sent offsite as nonhazardous waste. While the vehicle maintenance area was not a part of this assessment, it was learned that waste and used oil, oil filters, and other vehicle fluids from this facility are drummed and sent offsite for treatment.

It was observed that occasionally the water from the tank cleaning had a grayish color after passing through the bag filter

at the exit port of the tank. It was observed that the effluent from the settling tanks also had the grayish color. It was concluded that any waste minimization options should address this issue.

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. This particular facility presents a dilemma in determination of waste management costs. The present water handling system commingles the tank cleaning water and storm water runoff at the settling tanks and it is difficult to ascribe costs to each individual source. It is estimated that the annual solids removal costs are $1500. A very high estimate is that 25% of the solids come from the tank cleaning operation.

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. All values should be considered in that context. It must be frankly stated that any waste reduction option at this facility will result in no savings by standard calculation methods. It will be a net cost to evaluate and install any new procedures and technology. Not every pollution prevention option necessarily results in a cost savings. However, other savings not quantifiable by this study include a wide variety of possible future costs which will be incurred if the facility cannot discharge into the stream, or costs which may be incurred as a result of cleanup liability in the future.

As discussed previously, the pollution prevention challenge identified at this facility has to do with the cause and resolution of the gray color in the effluent water from the tank cleaning process. It is assumed that the color represents small quantities of material which are derived from the plastic pellets. Two possibilities were identified. It is possible that some types of pellets have a water-soluble additive which is removed by the water used in the cleaning. This was considered to be a remote possibility, however, based upon the relatively small quantity of pellets which remain in the tanks and the relatively large volume of water which is used in the cleaning.

The other possibility identified was that the color actually results from the presence of powdery fines from the pellets themselves. Such fines could result from grinding of the pellets against each other while they bump along the road as well as during filling and emptying procedures. Such fines are likely to be electrostatically charged and retained on the surface of the tank. Alternatively, the pellet rubbing could occur during the actual cleaning operation. This was seen as a less likely possibility for the same reasons as described above—the small quantity of pellets which remain in the tank prior to the cleaning operation.

One pollution prevention possibility is to develop a system to allow recycling of the water used in the cleaning operation. Presumably the fines (if that is the explanation) will settle out, given enough time. They could also be removed by filtration, coagulation, or flocculation. It appears uneconomical to construct a treatment system for this application. Addition of a storage tank with a second and finer filter to be used after the bag filter may address this situation. The water could be reused several times because its function in this application is primarily to push material.

Another option which should be evaluated is to remove any fines which may be adhering to the walls of the tank using air rather than water. Use of a directional nozzle, similar to that used presently to direct water streams, could assure coverage of the entire interior of the tank. It would be necessary to have a fine filter, and preferably a high volume vacuum filter at the exit port of the tank to capture the fines which would be passing out of the tank. Because of the potential for electrostatic charges on the fines, it may be preferable to ground the tank to dissipate this charge.

Regulatory Implications

There do not seem to be significant regulatory implications which would impede pollution prevention initiatives at this facility. It is likely that increased emphasis on the quality of water discharged directly to the stream will encourage pollution prevention at this facility. Careful and regular attention should be given to discharge requirements to assure compliance with all regulations.

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*
Aqueous Discharge to Settling Tank	*Effluent from the tank cleaning operation*	*2,500,000 gal*	*$375*

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Table 2. *Summary of Recommended Waste Minimization Opportunities*

Waste Stream Reduced	Minimization Opportunity	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Payback Years *
		Quantity	Percent			
Tank Cleaning Effluent	Installation of storage tank, filter, and pump to allow removal of the fines and recycling of the water. †	2,000,000 gal	80	$300	$10,000	33
	Installation of air pressure/ vacuum recovery system for removal of fines from the tank. It is not known if all of the pellets could be removed in this way as well. It is possible that the water wash could be eliminated.		Assume that water wash is still needed, then there will be no savings. If it is not needed, then the savings will be 100%.		4,000	0 - 13

* Savings result from reduced raw material and treatment and disposal costs when implementing each minimization opportunity independently.
† This option reduces the amount of fresh water needed but does not reduce water usage or contamination by fines.

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