CONTROL TECHNOLOGY ASSESSMENT OF HAZARDOUS WASTE DISPOSAL OPERATIONS IN CHEMICALS MANUFACTURING

Walk-Through Survey Report

of

E. I. du Pont de Nemours and Company
Chambers Works
Deepwater, New Jersey

SURVEY CONDUCTED BY:
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DATE OF SURVEY:
November 1981

REPORT WRITTEN BY:
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DATE OF REPORT:
January 1984

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Division of Physical Sciences and Engineering
Engineering Control Technology Branch
Chemical Industry Section
Cincinnati, Ohio 45226

PURPOSE OF SURVEY:	To conduct a preliminary study of hazardous waste disposal operations in chemicals manufacturing with a view to documenting exemplary controls.
EMPLOYER REPRESENTATIVES CONTACTED:	Ted Lewis, Manager, Environmental and Safety Services George Cassedy, Superintendent, Environmental Affairs Jack Micallef, Sr. Supervisor, Safety Mike Fahsel, Sr. Chemist, Environmental Health Harry Heath, Supervisor, Wastewater Treatment, Landfill, and Incinerator
EMPLOYEE REPRESENTATIVES CONTACTED:	None
STANDARD INDUSTRIAL CLASSIFICATION CATION OF PLANT:	Chemical and Allied Products Sector (SIC 28)

INTRODUCTION

The Resource Conservation and Recovery Act (RCRA) (PL-94-580) of 1976 was enacted to provide technical and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials, for the safe disposal of discarded materials, and to regulate the management of hazardous waste. Under Subtitle C of RCRA, the Environmental Protection Agency (EPA) was required to promulgate regulations on identification and listing of hazardous wastes and regulations affecting the generators, transporters, and owners/operators of facilities for the treatment, storage, and disposal of hazardous wastes. These regulations appeared in the Federal Register on May 8, 1980. Amendments affecting the listing of hazardous wastes appeared in the Federal Register November 12, 1980.

There are between 35 and 60 million tons of hazardous wastes generated annually, of which about 15 million are generated by industries in the Chemical and Allied Products Sector (SIC 28). These wastes contain toxic substances which may also be carcinogenic, mutagenic, and teratogenic. Some of the companies in SIC 28 treat, store, and dispose of the wastes that they generate. Wastes may also be transported to companies who specialize in the treatment, storage, and disposal of these wastes. This group of companies is classified as "Refuse Systems" (SIC 4953). It is estimated that about 18,000 workers are directly involved in the transportation, treatment, storage, and disposal of hazardous wastes from SIC 28.

There are many companies in both SIC 28 and SIC 4953 which are currently treating and disposing of hazardous wastes from chemicals manufacturing. Many of these companies have controls in place that are designed to protect the workers from known hazards, both during normal operations and during upsets or emergencies. The objective of this control technology study is to document and disseminate information on effective engineering controls, work practices, monitoring programs, and personal protective equipment. The NIOSH study will result in a technical report designed to assist hazardous waste operators in their efforts to prevent worker exposures to occupational health hazards.

Furthermore, an attempt will be made to present a spectrum of available alternatives for hazard control in various treatment and disposal operations.

The implementation of RCRA regulations has created business opportunities in the area of hazardous waste treatment and disposal. This has also created employment opportunities reflected by a steady rise in the number of workers who are involved in the treatment and disposal of hazardous wastes.

The Occupational Safety and Health Act of 1970 (PL-91-596) was enacted to "assure safe and healthful working conditions for men and women." The Act established the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health and Human Services. NIOSH was charged by this Act with the duty and responsibility to conduct research and develop guidance for preventing exposure of workers to harmful chemical and physical agents. In response to this legislative mandate, NIOSH has conducted major programs to document, develop, and disseminate information regarding the health effects of such agents. To complement these ongoing programs, NIOSH has instituted a major effort to prevent occupational health and safety problems through the assessment and application of control technology in the workplace.

This preliminary survey was conducted as part of a NIOSH project to assess and document effective controls in the routine disposal of hazardous wastes from chemicals manufacturing.

AUTHORITY

Two of the main policy objectives of the 1970 Occupational Safety and Health Act (PL-91-596) are to:

- Encourage employers and employees in their efforts to reduce the number of occupational safety and health hazards at their places of employment, and to stimulate employers and employees to institute new and to perfect existing programs for providing safe and healthful working conditions.
- Provide for research in the field of occupational safety and health with a view to developing innovative methods, techniques, and approaches for dealing with occupational safety and health.

Under Section 20 of the Act, the Secretary of Health and Human Services is authorized to conduct special research, experiments, and demonstrations relating to occupational safety and health as are necessary to explore new problems including those created by new technology.

Paragraph (d) requires the dissemination of the information obtained to employers and employees.

The National Institute for Occupational Safety and Health was established to perform the functions of the Secretary of Health and Human Services described in Sections 2 and 20 of the Act. The manner in which investigations of places of employment are conducted by NIOSH and its representatives is outline in the Code of Federal Regulations (Title 42, part 85a).

PLANT DESCRIPTION

The Du Pont Chambers Works is located between Rt. 130 and the Delaware River in Deepwater, New Jersey. It is a large multi-product chemical manufacturing complex. Products include fluorinated hydrocarbons ("Freon"), petroleum chemicals (tetra-alkyl lead), elastomers ("Viton" and "Hytrel"), specialty chemicals ("Zepel"), and aromatics such as phenylenediamines, toluidines, nitrotoluenes, dinitrobenzene, and substituted anilines. The site also uses nitric and sulfuric acids, alkaline compounds, and other inorganic materials.

The hazardous wastes generated by the various manufacturing processes are mostly treated and disposed of on the premises by one of four methods. These are: (1) incineration; (2) wastewater treatment; (3) thermal treatment, and (4) landfill. The wastes generated at this complex are diverse. The nature of the wastes and methods of treatment/disposal are summarized in Table 1.

Table 1. Major hazardous wastes and methods of treatment/disposal at the Du Pont Chambers Works.

Hazardous Waste	Incineration	Wastewater Treatment	Thermal	Landfill
Spent halogenated solvents[a]	X	X	-	-
Spent non-halogenated solvents[b]	X	X	-	-
Chlorinated species from ethyl chloride production	X	-	-	-
Ignitable	X	-	-	-
Corrosive	-	X	X	-
Lead	-	-	X	X
Miscellaneous Organics[c]	X*	-	-	X*
Miscellaneous Inorganics[d]	-	-	-	X

*(Mostly)

a. Solvents such as tetrachloroethylene, methylene chloride, carbon tetrachloride, chlorinated fluorocarbon, and chlorobenzene.
b. Solvents such as xylene, ethylbenzene, nitrobenzene, toluene, and methyl ethyl ketone.
c. Includes relatively small quantities of aldehydes, ketones, aliphatic, and aromatic amines, alcohols, halogenated aliphatic and aromatic hydrocarbons, esters, nitrated aliphatic and aromatic species, chlorinated phenols.
d. Includes arsenic oxides, fluorine, nitric oxide, zinc cyanide, phosgene, hydrofluoric acid, and mercury.

Wastewater treatment and incineration are 24-hour operations. The landfill is operated only during the day. Three workers operate the wastewater treatment plant and 7 operate the incinerator. The landfill is operated by 5 workers.

PROCESS DESCRIPTION

Wastes generated at the plant and "outside" wastes (disposed of for other concerns on a fee basis) are either incinerated, biologically treated in the wastewater treatment plant (WWTP), or landfilled. The incinerator handles combustible organic liquids that are generated at the plant while the landfill receives primary sludge from the WWTP and waste solids. The WWTP handles the remaining organics and acid wastes.

WASTEWATER AND THERMAL TREATMENT

The 40 mgd WWTP handles all compatible organic and inorganic wastes that are not incinerated or landfilled. The highly acid influent is first neutralized with lime and clarified. The "primary" sludge from clarification is dewatered in pressure leaf filters to 50 percent solids and sent to the landfill. The clear effluent is then mixed with activated carbon and pumped to the aeration tanks where non-biodegradable substances are adsorbed and others are biologically decomposed. The effluent from the aeration tanks is clarified and the clear effluent is pumped to the Delaware River. Part of the activated sludge is recycled to the aeration tanks while the rest is dewatered in pressure leaf filters prior to pyrolysis (thermal treatment). The last step takes place in a furnace wherein organic materials are burned-off and activated carbon is regenerated. Off gases from the furnace are first passed through two water scrubbers and then through an afterburner for complete combustion of volatile organics and smoke.

LANDFILL

The landfill receives about 420 acre-feet of material per year which is primarily composed of primary sludge and drummed solid wastes. No liquids or carcinogens are disposed of in the landfill.

The lining of the landfill consists of two layers of gravel (12" and 8", respectively) sandwiched between Typar(R) film on the top and a double layer of Typar(R) and Hypalon(R) plastic films on the bottom. These last two

films rest on a 12-inch layer of sand. The two layers of gravel are separated by a 4-inch layer of sand, which in turn has Typar/Hypalon(R) films on the top, and a Typar(R) film on the bottom.

There are monitoring wells and leak detectors installed. Leachate is collected and pumped to WWTP. Eventually, the 15-acre landfill will rise to 65-feet and will be covered with 1.5-feet of clay. A topsoil layer will be added thereafter.

INCINERATOR

This is a 5-ton/day, stationary, liquid-injection incinerator designed to burn combustible liquid organics. These are brought to the incinerator either by truck or by drum. There are five intermediate storage tanks that receive waste from the drum pad and from trucks unloaded at specially designed spots. These unloading operations were not witnessed during the survey. The gases from the incinerator are scrubbed in two stages. The first is a packed column and the second is a venturi scrubber. Mists and particulates are then removed in an irrigated electrostatic precipitator.

HAZARD CONTROL TECHNOLOGY

GENERAL CONSIDERATIONS

The basic elements of control technology which are implemented to reduce or eliminate hazards in the workplace are: (1) engineering controls; (2) environmental and medical monitoring; (3) training and education that results in effective work practices; and (4) personal protective equipment. Engineering controls include ventilation, enclosure or confinement of operation, substitution of hazardous agent, process modifications, and automation.

ENGINEERING CONTROLS

Wastewater Treatment

The hazards associated with this process do not warrant the implementation of controls beyond those found at ordinary wastewater treatment plants.

Landfill

Water from a tank trailer is sprayed periodically to suppress dust generation.

Incineration

The most important engineering controls are those associated with the outdoor transfer of organic liquids from trucks and drums to storage tanks. Other important controls are those employed to prevent or control fire and explosion.

No transfer operations were witnessed during the survey; however, plant personnel mentioned that vapor control devices are used. These consist of spot scrubbers. Another example of such controls is the recirculation of wastes to prevent buildup of grit in strainers.

ENVIRONMENTAL AND MEDICAL MONITORING

Every department within the plant has its own health and safety program. However, the plant senior supervisors for safety and environmental health provide advice and consultative services when needed.

Waste Water Treatment

Air monitoring (area samples) was conducted for total organic (nitrobenzene, benzene, and toluene) at the pump pit, top of the neutralizers, and top of the aerators. None of the concentrations exceeded the TLV's. This was conducted because of complaints about odor. There are administrative controls in effect which allow a worker to transfer to another job if he or she objects to the odor. The WWTP manager mentioned that the odor problem may be attributed to isopropyl alcohol in combination with other species.

Also of concern to the company were the effects of inhalation of fumes from and skin contact with primary sludge. Animal tests using guinea pigs were conducted to study these effects. Inhalation effects were studied by having the animal cages on top of beds of sludge. Skin effects were investigated by shaving the animal's skin and applying the sludge directly to the area to see if irritation developed. Some irritation was observed in the latter tests but no serious effects were uncovered.

Landfill

Area monitoring at the landfill consisted of area sampling for nitrobenzene and amines using impingers. The levels were not significant.

Incinerator

Personal monitoring at the incinerator was conducted for chloramines which apparently can cause the development of chloracne. Results of the sampling were not available at this writing.

WORK PRACTICES

During the survey detailed presentations were made on the safety and health program by the senior supervisor for safety and the senior chemist for environmental health. It was emphasized during the presentation that a key element in the success of any such program is the involvement of top company and plant management. It was also emphasized that, in general, company guidelines and rules that are in effect for other chemical manufacturing operations are also applied to hazardous waste handling and processing operations.

Every operation has written procedures and employees are required to strictly adhere to them. Alteration and modifications may occur only after consultation with and approval by management. The assistant plant manager heads a central safety and health committee with plant department superintendents as members. The committee meets once a month. There are subcommittees on safety standards, serious accident investigation, process hazards management, protective clothing and equipment, emergency and disasters, transportation of hazardous materials, industrial hygiene, and disaster prevention. The subcommittees meet on a monthly basis and minutes are published. Their findings may be used as inputs into the plant safety handbooks and plant guidelines for process hazards management.

Employee work practices are regularly audited by the senior supervisor for safety and his staff of five engineers. Every month they inspect the entire plant and observe the people who are working. These observations result in the calculation of an "Unsafe Acts Index" which tells plant management whether the plant safety is improving or not. There are also safety and work practice audits that are conducted within each department. These include housekeeping inspections, job cycle checks, and a "Project 96" program. The job cycle checks involve observation of the workers during the performance of the tasks or subtasks to which they are assigned by their immediate supervisors. Any departures from written procedures are discussed and the worker is expected to correct such departures. The "Project 96" program involves observation of

employee for short-time only (30 seconds) with feedback provided to the employee immediately thereafter.

The wage safety proctor program involves observation of the employee by fellow employees. The philosophy behind this is that unsafe acts by one employee may have the potential for job loss of other employees. Feedback is immediate.

PERSONAL PROTECTIVE EQUIPMENT

Hard hats, safety shoes, and safety glasses are required at most operations throughout the plant. However, there are additional items required at the three hazardous waste disposal sites.

Waste Water Treatment

Ear plugs are worn by operators in the vicinity of air compressors for the aerators and at vibratory conveyors of unloading lines.

Landfill

Half-mask dust respirators are worn by the landfill operators.

Incinerator

Operators who hook trucks for unloading and empty out drums are required to don face masks, rubber gloves, and booties.

CONCLUSIONS AND RECOMMENDATIONS

The hazardous waste disposal operations at the Chambers Works may be considered state-of-the-art from the point of view of environmental control and from the point of view of occupational safety and health. Presentations made by plant officials indicate a deep awareness of the important issues involved in implementing effective safety and health programs. All of the elements of a control technology program are well represented at the hazardous waste operations of wastewater treatment, incineration, and the landfill.

Significant engineering controls are found in the operation of the incinerator, particularly in the transfer of organic liquids from drums and storage tanks. The most important ones are vapor control devices and fire and explosion prevention controls.

The site is recommended for performance of a an in-depth survey in which the effectiveness of engineering and other controls are documented.