

CONTROL TECHNOLOGY ASSESSMENT OF HAZARDOUS WASTE
DISPOSAL OPERATIONS IN CHEMICALS MANUFACTURING

WALK-THROUGH SURVEY REPORT

OF

3M COMPANY
COTTAGE GROVE, MINNESOTA

SURVEY CONDUCTED BY:
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REPORT WRITTEN BY:
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National Institute for Occupational Safety and Health
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:

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EMPLOYEE REPRESENTATIVES
CONTACTED:

None

STANDARD INDUSTRIAL CLASSIFI-
CATION OF PLANT

Chemical and Allied Products Sector
(SIC 28)

ANALYTICAL WORK
PERFORMED BY:

N/A

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 6,200 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 also have hazard 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 which will be 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 in 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:

- o 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.
- o 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 3M Chemolite incinerator is part of a large chemical complex (Chemolite) located in Cottage Grove, Minnesota between Highway 61 and the Mississippi River. The incinerator, dedicated in 1972, was designed to dispose of industrial liquid and solid chemical wastes described in Table 1. The incinerator handles 600 gal/hr pumpable liquid and 4,000 lb/hr of nonpumpable solid and semisolid wastes (wet scrap). The facility includes a material handling building, five 10,000 gallon storage tanks for liquid wastes, and an especially designed feed system for 55 gallon drums, in addition to the rotary kiln.

Three operators per shift are necessary for normal operation of the facility with a total of 12 operators necessary for around the clock operation.

Table 1. Hazardous wastes disposed of at the
3M chemolite incinerator.

Hazardous Waste RCRA Designation	Major Constituents	Quantity
D001	Ignitable	20,000 tons/year
D003	Reactive	10,000 tons/year
P002	1-acetyl thiourea	1,000 pounds/year
P003	Acrolein	1,000 pounds/year
P005	Allyl alcohol	1,000 pounds/year
P022	Carbon disulfide	1,000 pounds/year
P028	alpha-chloro toluene	1,000 pounds/year
P053	Ethylene diamine	1,000 pounds/year
P067	2-Methyl aziridine	500 pounds/year
P100	1,2-propanediol	500 pounds/year
K086	Lead, hexavalent chromium	50 tons/year
F001	Spent halogenated solvents	100 tons/year
F002	Spent halogenated solvents	100 tons/year

PROCESS DESCRIPTION

Compatible pumpable wastes are pumped from 55 gallon drums to one of the 10,000 gallon tanks. Viscous wastes are tipped over a ventilated hopper by a forklift and are eventually mixed with the pumpable wastes. Care is taken to even out the BTU content and viscosity of the resultant combustible liquid stream. Non-pumpable wastes (e.g., oily rags and sludges) are fed directly into the kiln by a semiautomatic feed system that recovers the drum, if possible. Otherwise drum and contents are dropped into the kiln by the feed system. Figure 1 shows a schematic of the incinerator process.

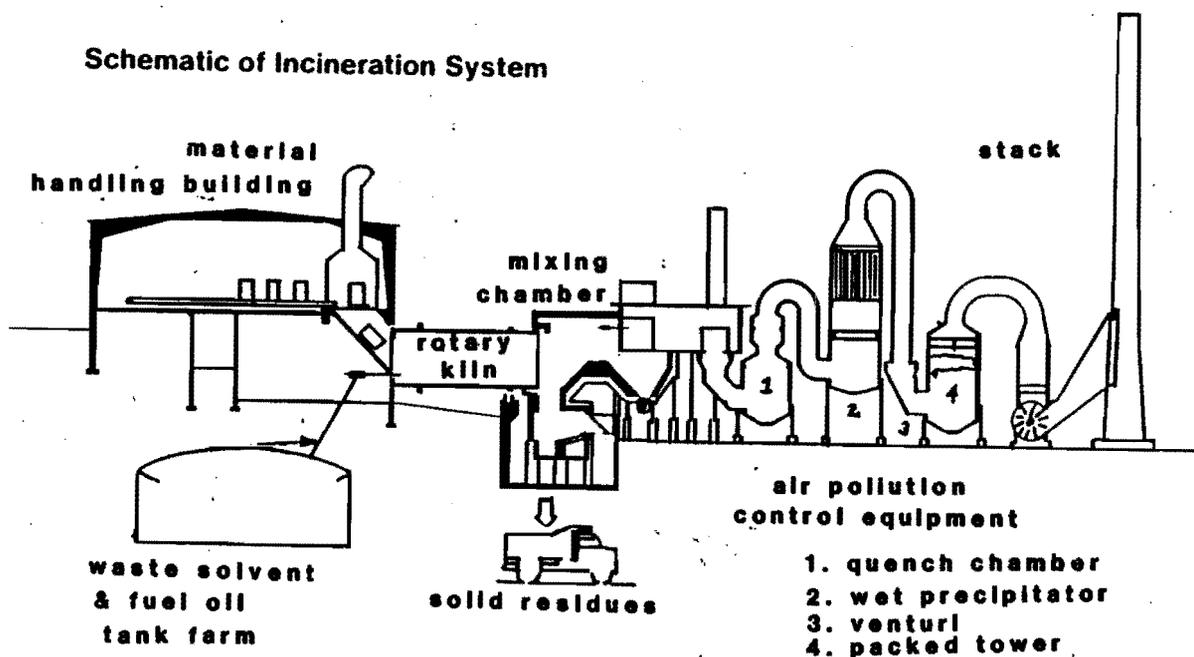


Figure 1. Process schematic of 3M Chemolite incinerator.

A burner at the front of the slowly rotating kiln burns the liquid wastes and maintains a minimum temperature of 1,100°F. The temperature may vary between 1,100°F and 2,200°F. Burned out drums and ash drop from the kiln

into a water quench chamber and then are carried on a conveyor belt to dump trucks for later disposal in a landfill.

Gas and smoke generated in the kiln flow through a mixing chamber and into the secondary combustion chamber. A burner in this chamber oxidizes the gases and smoke at 1,600^oF or higher. Gases from the secondary burner are quenched, scrubbed in a high energy venturi scrubber, and demisted in a mist eliminator. They then exit through a 200 foot stack.

HAZARD CONTROL TECHNOLOGY

GENERAL CONSIDERATIONS

The basic elements of control technology which are implemented to minimize 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

Safe and efficient operation of the incinerator depends significantly on labeling and careful segregation of the wastes. The waste is usually contained in 55 gallon drums. In addition to compliance with EPA and DOT requirements, the drums have company-designed labels which have information on major chemical contents and ratings of the health, fire, and instability hazards of the waste. The ratings are 0 to 4 with rating of four representing extreme hazard. In another area of the label, information on water reactivity and polymerizability is reported.

Pumpable hazardous wastes are pumped from their containers into one of the five storage tanks. Dilution ventilation at the rate of 12 room changes per hour is employed in that area. Containers with viscous liquids are inverted over a ventilated hopper using a forklift.

Nonpumpable wastes are fed directly to the incinerator using the semiautomatic feed system. The operator places the drum on a conveyor using a forklift and subsequently removes the cover. The drum is then automatically conveyed to the feed end of the kiln. The latter is maintained at a negative pressure of 0.2 in. H₂O and this should, under normal operation, prevent the diffusion of fumes from the feed end of the kiln into the workplace.

The control room for the incinerator is adjacent to the feed system described above. In case of fire at the feed system, workers in the control room are shielded by metal screens which unfold automatically. Heat from the fire causes links in the chains, which hold up the screens, to melt. Also, there is an overpressure relief mechanism installed at the feed end of the kiln to prevent explosions.

MONITORING

In 1973 and 1976, the company conducted personal sampling of operators who were pumping solvents (methyl ethyl ketone, toluene, and xylene) from open and closed head drums. Exposures to the solvents were calculated, assuming the additive effect as percent of the permissible exposure for each. The 1973 data showed combined exposures in the range of 0.03 to 0.08 for pumping closed head drums and 0.22 to 0.42 for open head drums. The 1976 data showed exposures between 0.11 and 0.23.

The exposure of operators loading drums on the kiln feed line and removing the cover were of the order of 0.01. These data were taken in 1976.

The 1973 samples were collected by means of impingers with subsequent analysis by ultraviolet and visible light spectrophotometry. The 1976 samples were collected on charcoal tubes and analyzed by gas chromatography.

In 1975 air sampling was performed at an area where a waste containing hydrofluoric acid was stored. The samples were collected using a basic solution in an impinger. The 27 minute samples showed concentrations less than 5 ppm.

WORK PRACTICES

Workers receive training in RCRA rules and regulations and fire prevention and control.

PERSONAL PROTECTIVE EQUIPMENT

Face shields and rubber gloves are worn when drums are being emptied in addition to hard hats and safety shoes. Special rubber jackets and pants are additionally required when handling corrosive materials.

CONCLUSIONS AND RECOMMENDATIONS

The waste incineration operations at the Chemolite facility appear to be technically advanced and environmentally sound. Housekeeping appeared to be very good and all drums containing waste were clearly labelled and neatly stacked. Ever since the incinerator began operation the company has exhibited concern about exposures resulting from transfer of hazardous wastes from drums. Measurements by the company show no overexposure.

This site appears to be an excellent candidate for the performance of a 3-day survey to document the effectiveness of controls.