

CONTROL TECHNOLOGY ASSESSMENT OF HAZARDOUS WASTE
DISPOSAL OPERATIONS IN CHEMICALS MANUFACTURING

Walk-Through Survey Report

of

Celanese Chemical Company
Clear Lake City, Texas

SURVEY CONDUCTED BY:
Mazen Anastas, Ph.D.
Michael S. Crandall

DATE OF SURVEY:
February 24, 1982

REPORT WRITTEN BY:
Mazen Anastas, Ph.D

DATE OF REPORT:
August 1982

REPORT NO.:
103-17a

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:

J. W. Dunn, Manager, Safety, Health,
and Environmental Affairs
R. E. Tower, Environmental Affairs
Group Leader
George R. Osborne, Industrial Hygienist

EMPLOYEE REPRESENTATIVES CONTACTED:

None

STANDARD INDUSTRIAL CLASSIFICATION
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 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 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:

- 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 processes at this plant utilize chemical conversions of petrochemical feed stocks and petrochemicals to produce useful organic chemicals, such as vinyl acetate, ethyl and butyl acrylate, and acrylic acids.

HAZARDOUS WASTES, WASTE TREATMENT, AND DISPOSAL

The "Part A" (RCRA) application for this plant lists every chemical in use regardless of quantity. The wastes listed are, in general, ignitable, corrosive, and reactive wastes. They include specific compounds in the general categories of aliphatic and aromatic hydrocarbons, halogenated hydrocarbons, alcohols, acrylates and acrylic acid, quinones, and some heavy metals. Quinones, used as polymerization inhibitors in the manufacture of vinyl acetate, are found in the distillation bottom waste streams at the 1,000 ppm level. Wastes containing chlorinated hydrocarbons are generated in degreasing operations used in the maintenance of process piping and equipment. The bulk of these are disposed of off-site by a contractor using chemical fixation with cement flue dust.

Three waste streams are generated in the acrylate manufacturing complex. The first is an air stream that results from ventilation of the pump houses. Another is an aqueous process waste stream. Both are incinerated in a waste heat boiler. The incineration operation is necessitated by the low odor threshold (1/2 ppb) of the acrylates. The third waste stream consists of waste polymeric materials which are burned in a small solids incinerator fitted with an afterburner.

Aqueous wastes containing small amounts (1 to 2 percent) of nonbiodegradable organics (halogenated hydrocarbons) are sand-filtered before injection into a deep well.

HAZARD CONTROL TECHNOLOGIES

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

From discussions with plant officials, it became evident that under routine operating conditions the waste streams from the acrylate manufacturing complex present odor, rather than exposure problems. The engineering controls for this problem consist of: (1) ventilating the pump houses; and (2) incineration of the ventilation air and the wastewater in a waste heat boiler. Also, ethyl acrylate pumps have devices that recycle seal leaks to the suction of the pumps.

MONITORING

Air monitoring of employees and the areas has been conducted at the deep well injection site and the acrylate manufacturing complex. Exposure measurements at the former were found to be below quantifiable levels. Sampling at the latter for acetic acid and ethyl and butyl acrylate indicated levels below 1 ppm which are well below applicable standards. The sampling and analysis method for ethyl and butyl acrylates utilizes Chromosorb 105 as a sampling medium and thermal desorption and gas chromatography techniques. Acetic acid is collected on activated carbon and desorbed using dimethyl formamide.

Medical monitoring is carried out routinely on an annual basis. A pre-employment physical is necessary and usually includes an occupational history, complete blood count, urinalysis, chest x-ray, pulmonary function test, 12-lead EKG, and a battery of biological tests known as SMAC-23. Data from the medical monitoring program are entered into a computer data bank. There is also a capability for performing epidemiological studies on production workers for the same chemical at different locations.

WORK PRACTICES

At this plant there are established formal training programs for employees who are potentially exposed to hazardous substances. Each employee has to demonstrate ability and knowledge to operate a process or a piece of equipment. A 4-hour training course outlining the hazards of chemicals in the plant is given by the industrial hygienist. Each process control room has a complete set of safety data sheets.

The company performs audits of contractors who dispose or treat hazardous wastes generated at this plant. The audit includes checks on: (1) housekeeping; (2) possession of appropriate permits for operation; (3) emission control systems; and (4) safeguards used at front-end feed systems.

PERSONAL PROTECTIVE EQUIPMENT

Scott Air Paks^(R) at strategic locations are used at the acrylate manufacturing complex for emergencies only. Qualitative fit testing for respirators has been used in the past. Quantitative fit testing will be performed in the future.

CONCLUSIONS AND RECOMMENDATIONS

Hazardous waste treatment at this site includes the use of deep-well injection. Air monitoring by the company revealed insignificant levels of various nonbiodegradable contaminants there. Observations made during the survey and discussions with plant officials seem to indicate that the hazard, and as a result, the controls, are relatively insignificant.

Engineering controls have been installed to control an odor problem from waste streams at the acrylate manufacturing complex. Contaminant levels are below standards under normal conditions.

Because the hazards associated with the hazardous waste disposal operation at this plant are relatively minor in comparison to other sites, no further study of the hazard controls is recommended.