

The chemical industry seems to be continually under attack on the grounds of workplace safety and health hazards it creates. The popular press has siezed upon incidences such as Love Canal and government reports linking excess cancer rates to chemical workers. These occurrences have been highly publicized in what has proven to be a distorted manner in most cases. Unfortunately, the other side of the story, what the industry is doing to improve worker safety and health and environmental control is seldom told. The fact is that the chemical industry is working constantly to assure worker safety and health and we feel this story should also be told. We all know that chemicals are essential to our modern way of life. The challenge is to manage them - to control them - so they present minimum risk to plant workers and the public which comes in contact with our products.

Safety has always been given the highest priority in the chemical industry. Today, because of these priorities, a chemical plant worker is more than two times safer than the average American worker. The National Safety Council reports that chemical workers are 2.3 times safer on the job than the average American worker.

However, chemical companies aren't standing on this achievement alone. Advances in scientific knowledge have shown us that previously undetected health effects can occur from exposure to some chemical substances in the workplace. As a result we are expanding our efforts in worker protection. We are now intergrating into our overall safety programs new procedures and new programs to limit worker exposure to hazardous substances and to promote worker health.

Professional safety personnel, industrial hygienist,² toxicologist,² occupational physicians and engineers are working together to anticipate and respond to problems and improve existing programs. Our efforts to do this center around five basic elements:

1. Employee Training
2. Medical Surveillance
3. Employee Exposure Measurements
4. Engineering Controls
5. Chemical Testing

Employee Training

Building on years of safety training we are now increasing training efforts on health hazards associated with the chemicals our employees come in contact with. Expanded training programs take a variety of forms: group meetings, poster, signs, and labels, videotapes and slide/tape programs.

At Conoco Chemicals this effort is constantly expanding.

- At every plant we have developed educational programs on general plant hazards and safety procedures as well as specific chemicals encountered in the plant.
- These programs are shown to all new employees before they begin work in the plant. Also, where feasible, contractors are given training applicable to their jobs in the plant even if they are to be there for only one day or work.
- As new information on chemical hazards is received these programs are updated or new ones prepared where necessary. Disclosure of new health hazard information can be a sensitive activity. It rests on a thin line between too-little-information-too-late and premature releases of preliminary data. We are constantly evaluating new information and presenting it to our employees in a timely understandable, common sense way.

- We are beginning to develop companion "hand-out" literature as a part of our slide/tape programs. This is for the employees to "take-home" and refer to anytime they may have further questions.

Medical Surveillance

Frequent medical tests for employees are now provided by many chemical companies to maintain the general health of the workers as well as to look for subtle changes that may occur as a result of exposures to particular chemicals. These test results are used to counsel individual employees as well as to look for trends or the development of previously unknown effects in groups of workers exposed to particular chemicals. Testing results also help to monitor the effectiveness of exposure control programs.

1. Conoco Chemicals provides annual physical exams to all it's operating and plant personnel. This program consists of a medical history, multi-phasic clinical exam including a specially selected group of laboratory tests and procedures, and a "hands-on" physician exam. The same exam is offered to all employees with additional sensitive tests for vinyl chloride, lead, and benzene exposures where applicable.
2. Each employee is given a copy of his exam results, or if requested they are sent to his or her family doctor.
3. This program is administered through a van-testing service on the plant site. Employees participating are given the exams during regular working hours.
4. The health examination is free of charge.
5. Where feasible the hands-on exam is performed by a Conoco physician, familiar with the individuals and particular plant conditions.

Employee Exposure Measurements

Where possible most chemical companies now monitor employee exposures to the chemicals they work with or are potentially exposed to. New and more sophisticated devices for monitoring the workplace environment are being developed. These range from personal monitors worn by the individual to continuous area monitoring devices. The monitoring is required by law for a very few chemicals encountered in today's modern and complex chemical industry, and most of the monitoring is done voluntarily by the companies.

Conoco Chemicals has extensive monitoring programs at the manufacturing plants.

1. Fixed-point continuous area monitoring systems are in use at the majority of our plants. In some plants the large amounts of data generated are processed and summarized by computer.
2. Personal monitoring is done on a regular scheduled basis at all our plants in order to evaluate worker exposures, and assure exposure control programs are working properly.
3. The Lake Charles VCM plant has devoted a summer student two years in a row to conduct supervised research on the efficiency of a new sampling device to be used in the plant. At the Baltimore plant a similar study was done to compare a new sampling method with the old method to assure it was applicable to plant conditions.
4. These sampling results are readily available to the employees.
5. For the Newark plant no suitable analytical technique was available for the cresylic acids to be monitored. Considerable time and money were expended in the plant laboratory to develop a method.
6. This data is maintained in a computer format and analyzed ~~periodically~~ to assure exposure levels are maintained at acceptable levels.

Engineering Controls

The best method to protect chemical workers is by addressing the problem of exposure to substances at the primary source - the processing equipment itself. The most efficient way to do this is in the design stage and significant progress is being made in this area. Engineers are working with health and safety professionals to review new processes and anticipate the possibility of exposures through all routes; inhalation, skin absorption and ingestion before construction begins. Where problems occur in existing plants process modifications are made, ranging from substitution of less toxic materials to enclosure of equipment to prevent release of physical or chemical agents.

Table I is a summary of the capital budget dollar amounts for health and safety projects of Conoco Chemicals plants since 1978.

	1981		1980		1979		1978	
	\$M	% Budget	\$M	% Budget	\$M	% Budget	\$M	% Budget
Aberdeen	855	12	974	13	505	14	489	25
Baltimore	489	10	1,920	38	117	3	727	22
Hammond							12	17
LCCP	99	2	631	8	118	3	238	12
LC VCM	103	8	893	39	142	8	15	8
Newark	102	13	43	1	136	11	192	23
OKC	1,498	57	355	22	---		---	

TABLE I →

Examples of what some of these projects include the following:

1. At Aberdeen it was necessary to frequently handle a chemical initiator in heated form to add it to the reaction system. This operation led to the potential for operator exposures to the chemical which is a respiratory and skin irritant. A project was designed to allow this chemical to be mechanically handled through a bulk handling system, eliminating the major exposure potential for the operators.

*we saw
the same
project
in the
past*

2. Pumps with mechanical seals were found to be chronic leakers at the Newark Plant, creating a personnel exposure and fire hazard. To reduce these hazards the plant is systematically replacing the old pumps with sealless pumps.
3. A project to improve a fixed point monitoring system for Vinyl Chloride already in existence at Aberdeen included:
 - a. installation of a computer system to gather, analyze and reduce the data from 40 monitoring points.
 - b. installation of automatically activated warning lights for high concentrations of VCM
 - c. Alarm and print-out capability for any leak detected.
4. At the Baltimore plant several major projects are in the works to reduce fugitive benzene emissions and reduce operator exposures.
 - a. a benzene stripper system is being installed to remove benzene from water streams containing benzene. This will remove benzene from process sewers, the API separator and other identified areas of high benzene exposure.
 - b. a vent collection system was designed to enclose process vents releasing benzene to the air and contain emissions for recycle.
 - c. Several smaller projects are underway to reduce benzene exposures on the loading rack, during tank gauging and process sampling.
5. It was recently discovered that significant concentrations of unreacted ethylene oxide were present in finished ethoxylate product. This created the potential for high short term exposures to EO. The process was modified to assure a more complete reaction as well as major equipment additions to allow for further cooling and purging of the product, further reducing residual EO concentrations.

6. At the VCM plant dock a major project was designed to control emissions and exposures to EDC during barge and ship unloading. Revisions to the dock system included piping for loading and vent line purging, a new line to vent the ship's vent to a stack presently located in the dock area, a double tandem seal arrangement for the EDC loading pump, and a fixed point monitoring system.
7. An extensive dust control system was added to a PVC railcar loading facility at Oklahoma City to control dust emissions during this operation.
8. A closed sewer system was installed at the VCM plant to control EDC emissions from the process sewers. ~~These emissions were a major source of exposure.~~
9. At Aberdeen the plasticizer production was modified to correct identified exposure sources. This project included:
 - a. A closed reactor charging system installed to prevent exposures during reactor charging of additives.
 - b. Process vents were rerouted to remove vapors from the work area.
 - c. A closed filtering system was installed to replace the existing open filters which released vapors to the work area.
 - d. A closed gauging system was installed on two phthalic anhydride tanks to reduce exposures during tank gauging.
10. Numerous other projects are included in all plant budgets every year for health and safety. These projects include such things as fire water system improvements, plant lighting improvements, upgrading of walking surfaces and loading racks, explosive vapor detection and warning systems and purchase of protective equipment.

Chemical Testing

Chemical companies engage in a broad spectrum of toxicological research with animals such as rats and mice to determine a chemicals safe exposure level and what ways it may be toxic. This research includes many tests ranging from acute toxicity, skin irritation, sensitization and bio-concentration factors to metabolic rate and long-term inhalation tests. Tests are conducted on raw materials, intermediates and products to assure the safety of employees as well as consumers.

1. Conoco chemicals does testing of it's products through contract testing laboratories. Generally a prescribed battery of acute tests is run, and if those results indicate further testing is done. Following are the testing costs for the past several years.

1977 - \$14,000

1978 - 12,300

1979 - 6,700

1980 - 30,000

1981 (6 mo) - 18,600

2. In addition to this internal testing Conoco Chemicals joins with 34 other chemical companies in supporting the Chemical Industry Institute of Toxicology (CIIT). CIIT spends \$12 million annually on testing and research programs.

CIIT's charter states that the data resulting from it's work must be available to everyone - the public, government, academia, and industry - and that adverse information as well as results indicating low or no toxicity must be published.

3. Through a professional corporate toxicologist and other information and publication services we keep abreast of other new toxicological or health affect information that may bear on our products and people.

Besides these basic elements of our program, we also participate in other activities. Conoco actively participates in various trade associations, such as the Chemical Manufacturer's Association, American Petroleum Institute and Organization Resource Counselors. These activities allow us to share our knowledge and experiences with others in the industry and keep abreast of the most recent developments in safety and health.

Our education efforts are directed not only to our employees, but often extend to contractors and neighboring communities. Our on-job safety programs instill a safety awareness which seems to carry over to the home lives of our personnel. This is witnessed by lower off-the job accident rates for chemical industry employees.

The examples cited may seem like alot. They are offered only to illustrate the fact that Conoco Chemicals, and the Chemical Industry consider health and safety efforts as a normal and intregal part of doing business. Chemical workers should not have to choose between a good job and good health. We are firmly convinced that we have made that kind of choice unnecessary.