Phillips 66 Company
Houston Chemical Complex
Explosion and Fire

Implications for Safety and Health
in the Petrochemical Industry

A Report to the President

U.S. Department of Labor
Elizabeth Dole, Secretary

Occupational Safety and Health Administration
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U.S. DEPARTMENT OF LABOR

OFFICE OF THE SECRETARY
WASHINGTON, D.C.
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The Honorable George Bush
President of the United States
The White House
Washington, D.C. 20500

Dear Mr. President:

In the early afternoon of October 23, 1989, a massive and devastating explosion and fire ripped through the Phillips 66 Company's Houston Chemical Complex (HCC), killing 23 persons--all working at the facility--and injuring more than 130 others. In addition to the tragic loss of life and injuries, the explosion affected all facilities within the complex, causing nearly three-quarters of a billion dollars worth of damage. The two polyethylene production plants nearest the source of the blast were destroyed, and in the HCC administration building nearly one-half mile away, windows were shattered and bricks ripped out. The initial explosion had the force of 2.4 tons of TNT and was equivalent to an earthquake registering 3.5 on the Richter Scale.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor, the Federal agency charged with the responsibility for assuring a safe and healthful workplace, arrived at the Phillips site within an hour of the accident. The other Federal agencies, particularly the U.S. Environmental Protection Agency (EPA), State agencies, and emergency responders--which have important responsibilities for public safety, the environment, firefighting, and search and rescue--also responded immediately to the disaster. That very afternoon, I dispatched the newly confirmed Assistant Secretary for OSHA, Gerard F. Scannell, to the scene, and by week's end, I promised a complete and comprehensive report to you on the findings of the OSHA investigation.

OSHA's comprehensive investigation of the accident was initiated immediately. The objective of the investigation was not only to determine the cause of the accident and any violations of the Occupational Safety and Health Act (OSH Act) that might have occurred, but also to identify steps that the petrochemical industry, labor, OSHA, and others should take to prevent similar accidents in the future. During the search and rescue effort, OSHA provided technical assistance to the responders, including firefighters, police, and medical personnel. OSHA also coordinated its activities with the Federal, State, and local agencies that responded to the accident, including EPA.

The Department expanded its investigation beyond the Phillips event to include a review of what are believed to be some of the most critical issues within the petrochemical industry, focusing particularly on those sectors of the industry identified as having the greatest potential for catastrophic accidents. This report, therefore, in addition to OSHA's findings from its investigation of the Phillips 66 accident in Pasadena, Texas, includes a profile of the petrochemical industry, an analysis of its accident history, and a preliminary review of industry work practices, particularly the relationship between plant personnel and outside contractor personnel. Labor organizations, industrial firms, trade associations, academic institutions, and other professional organizations have all contributed to the development of this review.

Finally, actions are proposed to protect against catastrophic petrochemical workplace accidents and to mitigate the effects of any that might occur. Later this year, we will have the final results of our review of the safety and health implications of the use of contractors for maintenance and other operations in the petrochemical industry. At that time, we may have further recommendations, and we will bring together senior officials from labor organizations, the petrochemical industry, and maintenance contractors to review the findings.

Accidents such as this can and must be prevented through better chemical process safety management, better training of workers, and better emergency response procedures. This report identifies those procedures, policies, and regulations that warrant improvement and acts as a catalyst to assure that labor, industry, and the Federal Government work together to improve safety in the petrochemical industry.

The Department of Labor and I grieve the loss of these workers. We are committed to taking the necessary steps to prevent such a loss in the future.

Elizabeth Dole

Elizabeth H. Dole

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THE PHILLIPS 66 COMPANY HOUSTON CHEMICAL COMPLEX EXPLOSION AND FIRE

On October 23, 1989, at approximately 1:00 p.m., an explosion and fire ripped through the Phillips 66 Company Houston Chemical Complex in Pasadena, Texas. Twenty-three workers were killed and more than 130 were injured. Property damage was nearly three-quarters of a billion dollars. Secretary of Labor Elizabeth Dole pledged a thorough and comprehensive investigation of the accident to determine the cause and to recommend actions to prevent such accidents in the future.

There was a need for such an investigation and for this report. Since the disastrous release of methyl isocyanate from a Union Carbide facility in Bhopal, India, in December 1984, the Department of Labor's Occupational Safety and Health Administration (OSHA) has been concerned about the possibility of a catastrophe occurring in a petrochemical plant in this country.

OSHA's investigations in 1984 and 1985 of all U.S. producers and users of methyl isocyanate and of a subsequent accident at a Union Carbide facility in West Virginia indicated the need to look beyond existing OSHA standards to the best company and industry control measures and systems for managing the hazards of the chemical process.

OSHA developed a "system safety" approach to chemical accident investigations through a special emphasis program of inspections at 40 chemical-processing plants in 1985 and 1986 (ChemSep). At the same time, the agency began to revise its existing standard for safe handling and storage of hazardous materials to include requirements for management systems that would ensure the safety of the chemical process. This effort was the precursor of the agency's current rulemaking for a standard for Process Safety Management of Highly Hazardous Chemicals.

The catastrophe at the Phillips Complex underscored the need for effective implementation of good safety management systems in the petrochemical industry and raised questions about diffused responsibility for employee safety at worksites where one or more contractors are engaged in work for a company. OSHA had addressed this issue at construction sites, but not at petrochemical plants like the Phillips Complex, where an engineering contractor was regularly employed to perform key maintenance operations and was involved in the October 1989 disaster. The Department of Labor therefore determined that OSHA's investigation of this tragic accident would be broad in scope and would examine the underlying causes

consequences and that the Department would report to the President with findings and recommendations.

The Phillips Complex produces high-density polyethylene, a plastic material used to make milk bottles and other containers. Prior to the accident, the facility produced approximately 1.5 billion pounds of the material per year. It employed 905 company employees and approximately 600 daily contract employees, who were engaged primarily in regular maintenance activities and new plant construction.

The accident resulted from a release of extremely flammable process gases that occurred during regular maintenance operations on one of the plant's polyethylene reactors. The evidence shows that more than 85,000 pounds of highly flammable gases were released through an open valve. A vapor cloud formed and traveled rapidly through the polyethylene plant. Within 90 to 120 seconds, the vapor cloud came into contact with an ignition source and exploded with the force of 2.4 tons of TNT.

OSHA investigated the causes of the accident concurrently with the investigation of possible violations of the Occupational Safety and Health Act (OSH Act). During the emergency response to the accident and during the investigation, OSHA coordinated with the U.S. Environmental Protection Agency (EPA) as well as other agencies. In the course of this extensive investigation, thousands of pages of documents relating to the facilities, the equipment, and company and contractor work practices were reviewed; scores of witnesses were interviewed; and critical pieces of evidence from the debris were subjected to laboratory and other tests.

OSHA's investigation revealed that a number of company audits, which were done by Phillips' own safety personnel as well as by outside consultants, had identified unsafe conditions, but had been largely ignored. The investigation further revealed an absence of effective management systems that resulted in the failure:

- to prevent the uncontrolled release of flammable vapors.
- to minimize the effects of a release of flammable vapors, including the elimination of possible ignition sources.
- to provide adequate fire protection.

Thus, a citation for willful violations of the OSH Act "general duty" clause has been issued to Phillips with proposed penalties of $5,660,000. In addition, citations with proposed penalties of $6,200 have been issued for serious violations in the areas of emergency response, emergency egress, inadequate pre-emergency planning, plant alarm systems, hazard communication, and respiratory protection.

A citation for willful violations with proposed penalties of $724,000 has been issued to Fish Engineering and Construction (a Phillips maintenance contractor) for failing to obtain the necessary vehicle and hot work permits when working in the polyethylene plant. Citations for serious violations with proposed penalties of $5,500 have also been issued for hazards involving inadequate respiratory protection and deficiencies in the company's hazard communication program; other than serious violations involving mainly recordkeeping issues resulted in an additional $100 proposed penalty.

As a result of its findings in this investigation, the Department of Labor is committed to a course of action directed toward preventing catastrophic chemical accidents. The following are the actions the Department has pledged to undertake:

I. OSHA will expedite completion of its rulemaking requiring employers to implement comprehensive chemical process safety management plans for hazardous chemical processes.

II. OSHA will revise its current system for setting agency priorities to identify and include the risk of catastrophic events in the petrochemical industry.

III. OSHA will establish a catastrophe investigation protocol that will include plans, procedures, and an administrative framework to be activated in the event of a catastrophic accident.

IV. The Department of Labor will work with EPA to develop a joint investigation strategy for catastrophic chemical accidents that affect workers within the plant and the public and the environment outside the plant.

V. OSHA will employ all means at its disposal to ensure that every establishment in the petrochemical industry implements technologies and safe work practices that are widely accepted and generally used by the industry and its contractors. The agency will encourage the petrochemical industry to incorporate new technologies into chemical processes that would decrease the likelihood of a workplace accident.

VI. OSHA will sponsor a conference of industry, labor and government leaders on the lessons learned from the Phillips disaster. The results of the study on the petrochemical industry's practice of contracting out maintenance work will be presented. Representatives from other Federal agencies and foreign countries will be invited to participate in a discussion of ways to improve worker safety and health in the petrochemical industry.

VII. OSHA will urge agencies involved in the collection of information on chemical accidents and incidents to establish an interagency working group to review available data systems with a view to including more information on the causes of chemical accidents.

VIII. OSHA will periodically publish *ChemAlert* bulletins.

OSHA's investigation of the Phillips catastrophe confirms the importance of (1) determining not only the precipitating circumstances of an accident but the underlying causes, (2) identifying the actions needed to prevent recurrence, and (3) widely disseminating the knowledge gained. Above all, the actions proposed in this report underscore the urgent need for increased attention to the established principles of process safety management.

The most critical responsibilities for chemical process safety rest not with government agencies but with industry, and specifically with each petrochemical producer, at each location or workplace. Through regulation, enforcement, technical assistance, training and other means, OSHA acts to ensure that employers fulfill their responsibility with regard to chemical process safety for employees as well as other types of worker hazards. OSHA's role, however, is not that of a supervisory body for the industry or for the individual plant; as specified in the OSH Act, the responsibility for the safe operation of any workplace always remains with the employer.