The report shows a statistically significant increase in the risk for developing myelogenous leukemia among workers exposed to benzene. We hope this new information will be of assistance to you in reaching a decision on the most appropriate regulatory action.

In his letter of April 15, 1977, transmitting the report on the Goodyear Pliofilm plant, the Director of NIOSH again urged that an emergency standard be issued.

REASONS FOR ISSUANCE OF AN EMERGENCY TEMPORARY STANDARD

The Assistant Secretary finds that exposure to benzene poses a grave danger to humans. Specifically, human exposure to benzene can induce chromosomal aberrations, bone marrow damage and destruction, and other blood dyscrasias. Moreover, the accumulated studies strongly support the conclusion that benzene causes leukemia in humans. The data collected by NIOSH and made available during the past few weeks show that workers exposed to benzene in an Ohio Pliofilm plant have contracted leukemia at a rate at least five times the rate expected in the general population. Because of the conservative statistical approach to evaluating these preliminary data, final results of this study will certainly show that the increased risk of developing leukemia from exposure to benzene is even greater than five times the normal incidence of this disease. This new evidence has been interpreted by NIOSH, and is found by OSHA, to conclusively establish that benzene causes leukemia in humans. This conclusion is supported by the substantial body of clinical and epidemiological evidence previously vail- epidemiological evidence previously available which suggested the same casual relationship between benzene exposure and leukemia. In view of the new evidence the relationship can no longer be subject to serious question.

The Assistant Secretary concludes, based on a review of the latest NIOSH study and recommendations together with the epidemiological and clinical studies and other scientific data, that benzene exposure subjects workers to the risk of contracting leukemia, a malignant and irreversible disease. The best available scientific evidence indicates that no safe level for exposure to a carcinogen, including benzene, can be established or assumed to exist. OSHA has considered this question of a safe level in previous rulemaking proceedings (see preambles to carcinogen standards (39 FR 3758), vinyl chloride standard (39 FR 35892), and coke oven emissions standard (41 FR 46742)) and has relied on that considerable body of scientific opinion holding that, when dealing with a carcinogen, no safe level exists for any given population. For example, the National Cancer Institute's Ad Hoc Committee on the Evaluation of Low Levels of Environmental Chemical Carcinogens (1970) states:

No level of exposure to a chemical carcinogen should be considered toxicologically insignificant for man. For carcinogenic agents, a "safe level for man" cannot be established by application of our present knowledge. (NCI, 1970, p. 1)

And NIOSH has taken the position that in regulating cancer-causing substances "* * * it is not possible at present to determine a safe exposure level for carcinogens." (Rev. Arsenic Crit. Doc. 1975.)

Since leukemia is a form of cancer and exposures generally below 25 ppm have already induced leukemia, it is not currently possible to determine whether a safe level of exposure exists for worker populations exposed to benzene. Therefore, the Assistant Secretary has determined that exposure must be reduced to the lowest feasible level.

Furthermore, during the period of time for normal rulemaking, workers would continue to be exposed to levels higher than those that may be achieved by this ETS.

In conclusion, the Assistant Secretary determines that exposure of employees to a cancer-causing substance in the workplace environment is a "grave danger" within the meaning of section 6(c)(1)(A) of the Act. The proposition that cancer, and substances that cause cancer, pose a grave danger to man does not need lengthy discussion. The nature of a cancer hazard differs from other types of toxicity. Employees exposed to carcinogens risk incurable, irreversible and, in most cases, fatal consequences. These consequences may be irreversibly set in time. No symptomatic evidence of the development of the cancer may be apparent to the employee during a long latency period. A single exposure episode may be sufficient to cause cancer. These factors, which establish the grave danger posed by exposure to carcinogens, also lead inexorably to the conclusion that it is necessary to provide immediate protection for employees through the issuance of an emergency temporary standard, within the meaning of section 6(c)(1)(B) of the Act.

The existing 10 ppm standard, adopted from the ANSI national consensus standard, was based largely on benzene's general toxicity rather than on the leukemia hazard and, therefore, does not, within the meaning of section 6(b)(8) of the Act, provide the protection now shown to be necessary. The Assistant Secretary finds that this emergency temporary standard better effectuates the purposes of the Act than the National consensus standard.

BACKGROUND AND DISCUSSION OF EARLIER DATA

Benzene (C6H6) is a clear, colorless, non-corrosive, highly flammable liquid with a strong, rather pleasant odor. Benzene's low boiling point and high vapor pressure cause it to evaporate rapidly under ordinary atmospheric conditions, giving off vapors nearly three times heavier than air.

Benzene is produced primarily by the petrochemical and petroleum refining industries by the process called catalytic reformation, which converts certain lower octane hydrocarbons into higher octane aromatics. The two industries are responsible for 94 percent of the total U.S. production of benzene. Recovery through catalytic reformation, including the benzene formed from the hydrodealkylation of toluene, accounts for almost 80 percent of the total quantity produced. Recovery of coal-derived benzene, primarily as a by-product of the coking process in steel mills, was once the major source of benzene. Today, however, it accounts for only 6 percent of the total U.S. production.

The production of benzene is rapidly expanding with approximately 11 billion pounds produced in 1976. Only eleven other chemicals and only one other hydrocarbon (ethylene) are produced in greater tonnage in the U.S. Approximately 86 percent of this benzene is used chiefly as an intermediate in the production of other organic chemicals, including styrene, phenol, and cyclohexane. The remaining amount is used primarily in the manufacture of detergents, pesticides, solvents and paint removers. Benzene is also present as a component of motor fuels, averaging less than 2 percent in gasoline.

The first major industrial use of benzene, however, was as a solvent in the rubber industry just preceding World War I. During World War I, benzene production was stimulated greatly by the demand for and resulting production of toluene in the manufacture of explosives. The large quantities of benzene which were produced resulted in its more widespread use as a starting point for the manufacture of various organic compounds. This situation led to greatly increased uses of benzene as a solvent in the artificial leather, rubber goods, and rotogravure industries, and as a starting material in organic synthesis.

Industries and processes currently using benzene include the chemical, printing, lithograph, rubber cements, rubber fabricating, paint, varnish, stain removers, adhesives, and petroleum industries. Benzene is also used extensively in chemical laboratories as a solvent and as a reactant in numerous chemical applications. Where benzene is produced and used in large amounts, it is generally used in enclosed systems, although exposures can occur during liquid transfer operations, from equipment leakage and carryover losses, and in maintenance operations.

A. *Toxic effects*. Benzene has been recognized as a toxic substance capable of causing acute or chronic effects since 1900. Inhalation is the primary route of entry of benzene in the worker. Benzene diffuses rapidly through the lungs and is quickly absorbed into the blood. The rate of absorption is greatest during the first five minutes and thereafter declines significantly. Benzene saturation of the circulating blood may reach as high as 70-80 percent of the air content of benzene within the first 30 minutes. Relatively complete saturation of the blood may not be attained for two to three days.

Though the available literature suggests that benzene is not readily absorbed through the human skin, appreciable