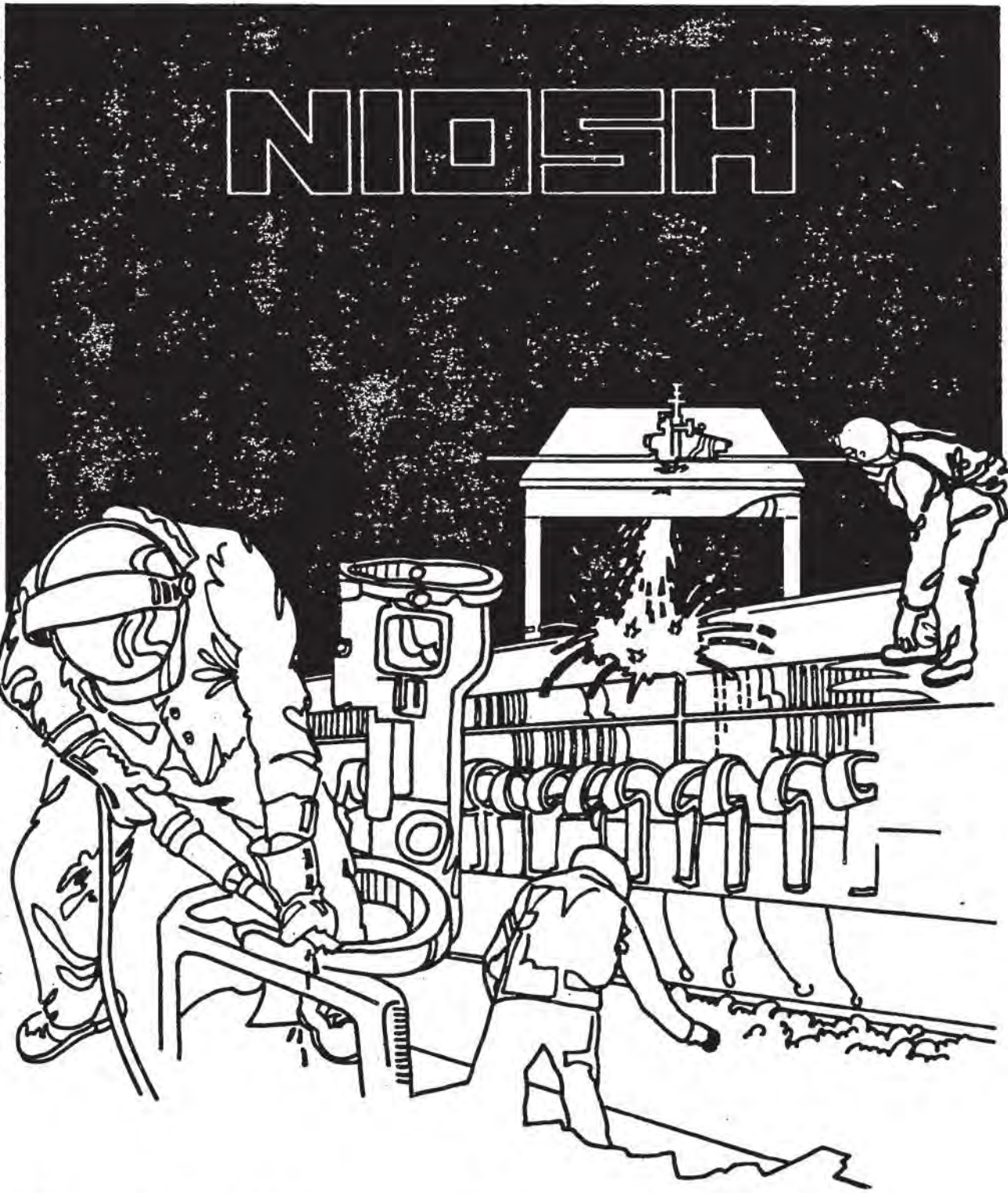
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HETA 82-285-1339
PLASTIFAX COMPANY
EXPLOSION SITE
GULFPORT, MISSISSIPPI

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 82-285-1339
JULY 1983
PLASTIFAX COMPANY EXPLOSION SITE
GULFPORT, MISSISSIPPI

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I. SUMMARY

On June 4-11, 1982, a health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the site of the Plastifax Company, Gulfport, Mississippi. The evaluation focused on the effects of an explosion and accompanying fire that occurred at this location on June 2, 1982. The explosion took place during the nitration of 2-ethyl hexanol to produce 2-ethyl hexyl nitrate. Metal debris was scattered nearly a mile away. Chemicals were released into the environment. These included mainly acids, 2-ethyl hexanol, and products of combustion of resins. Three workers on site were killed apparently by severe traumatic injury, and nine of the eleven survivors hospitalized. Forty-four of the rescue workers who responded to the incident were interviewed, of whom 45% used respiratory protection. Eight out of the 20 workers with respiratory protection reported that their self-contained breathing apparatus ran out of air while in use. There was no significant difference in hospitalization rates between those with respiratory protection and those without. However, 15 of the 24 rescue workers without respiratory protection had symptoms lasting more than a day compared to six of the 20 with respiratory protection (Chi square = 3.41, $p < 0.1$). The most common symptoms in rescue workers were cough, headache, and eye irritation. None of the 25 workers in the two adjacent factories nor any of the 47 interviewed residents of a nearby trailer park were hospitalized. Fifty-two percent of the workers in the two adjacent factories and 47% of the residents interviewed were symptom-free. In those with symptoms, eye irritation, sore throat, and cough were among the symptoms most commonly reported.

On the basis of the information obtained during this investigation, NIOSH has described the morbidity and mortality occurring as a direct result of the explosion and fire at Plastifax Company on June 2, 1982. Discussion on the prevention of such incidents and recommendations towards reducing morbidity and providing adequate clean-up worker protection are presented in Section VI of this report.

KEYWORDS: SIC 2899 (Miscellaneous Chemical Products.), 2-ethyl hexyl nitrate, explosions, chemical emergency response, nitration reactions

II. INTRODUCTION

On Wednesday, June 2, 1982, at about 1:40 P.M., an explosion occurred at the Plastifax Company in Gulfport, Mississippi. The explosion killed three workers and caused 87 others (mainly rescue workers, other workers on the Plastifax premises, and a few by-standers) to be taken to hospitals for medical attention. Damage also occurred to chemical storage containers and processing equipment throughout the plant, and chemicals were released onto the ground and into the air. The explosion also started a fire at two warehouses in the adjacent Chemfax factory. This caused the release of smoke and other products of combustion of the warehouse contents into the atmosphere. The chemicals released threatened contamination of ground water and a nearby surface waterway. The Emergency Response Section of the Environment Protection Agency (EPA), Region IV, therefore assumed responsibility for control and clean-up of the chemical wastes under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, also known as the Superfund Act.

On June 4, 1982, EPA requested the Centers for Disease Control (CDC) to evaluate potential health implications of airborne emissions from the explosion and accompanying chemical fire, and of potentially hazardous wastes and residues left at the site. In response to this request, personnel from CDC's National Institute for Occupational Safety and Health (NIOSH) were sent to the scene of the explosion. The response team consisted of an industrial hygienist from the NIOSH Region IV office, Atlanta, Georgia (the DHHS/PHS regional representative on the Regional Response Team), and two NIOSH occupational physicians from Cincinnati, Ohio. They conducted an evaluation during the period June 4 - 11, 1982.

III. BACKGROUND

The Plastifax Company of Gulfport, Mississippi is a small chemical company situated in the industrial seaway zone of the town. Figure 1 shows its location in relation to adjacent factories, highways, and the waterway. There were 14 workers present on the Plastifax premises on the day of the incident. The company acted as a toll manufacturing firm, dealing primarily with contract chemical production for its customers, and occasionally producing various chemicals for direct sale. During the period before the explosion, the main manufacturing activity was making water softeners and some chlorinated paraffins, most of which were stored in large fibrous glass or steel storage tanks on the premises.

IV. EVALUATION DESIGN AND METHODS

NIOSH was called to the scene two days after the explosion and fire. We were, therefore, unable to determine quantitatively the magnitude of exposure to factory workers, rescue workers, local emergency response personnel, or bystanders. We focused on determining the types of chemicals to which people were exposed in order to address what types

of health effects could be anticipated. As far as we could determine, no agency had performed a comprehensive analysis of air, water, or residual chemical wastes to determine their exact identities or concentrations. We, therefore, relied mainly on reports from the management officials of Plastifax and Chemfax for the composition of substances involved and released in the explosion and fire.

Most of the background information was obtained by personal interviews with factory personnel and those involved in the rescue operations. The State of Mississippi Bureau of Pollution Control, safety inspectors and industrial hygienists from OSHA, the Harrison County Coroner's office, and the Harrison County Civil Defense Department provided other useful data. Staff from the Harrison County Health Department assisted with interviews of residents in the vicinity of the explosion site.

The industrial hygiene and environmental health hazard evaluation components of our investigation concentrated on two areas: (1) identifying the chemicals to which people were exposed as a result of the explosion and fire, in order to advise what potential health risks might be involved, and (2) reviewing the occupational safety and health measures being taken to protect clean-up and other response workers during the clean-up phase at the site.

A medical and epidemiologic investigation was conducted by the NIOSH occupational physicians. A standardized questionnaire was administered to as many as possible of those who were in the vicinity of the explosion and who were taken to one of the three local hospitals for medical attention. Hospital records were reviewed at two of these hospitals: the Memorial Hospital at Gulfport and the Garden Park Hospital. The Gulf Coast Community Hospital provided a list of patients who were then interviewed by phone. A similiar questionnaire was administered to 25 out of 26 workers in the nearest factories located east and west of the explosion site. These factories were Hydro-Carbide Corp. and Chemfax respectively. Fifteen out of 16 workers from Hydro-Carbide Corp. and all ten workers from Chemfax were interviewed. The south side of the Plastifax premises is bounded by a bulk gasoline storage facility and a narrow waterway, the Gulfport Industrial Seaway, which were upwind of the Plastifax premises on the day of the explosion. On the north side are a trailer park and a residential neighborhood of single-family houses, which were downwind of Plastifax on the day of the explosion. The questionnaire was also administered to a sample of residents in this area from dwellings immediately in the direction of the wind-borne emissions from the explosion site. Responses were obtained from 47 households.

V. FINDINGS & RESULTS

A. Circumstances of the Explosion

On the day of the explosion, the Plastifax factory was apparently being used for the first production (by this process at this plant) of a fuel additive: 2-ethyl hexyl nitrate. The process involved

the addition of 2-ethyl hexanol to a mixture of anhydrous nitric and sulfuric acids in a large 2,000-gallon steel batch reactor vessel. The reaction is exothermic, and a cooling system was used to control the temperature of the reaction. Two refrigeration contractor employees and three employees of NL Treatment Chemicals of Channel View, Texas (the company that contracted with Plastifax to make the 2-ethyl hexyl nitrate) were on the site at the time of the explosion.

B. Effects of the Explosion

1. Chemicals and Emissions Released

The explosion started a fire at two warehouses in the adjacent Chemfax factory to the west of Plastifax. The contents of the warehouses were completely incinerated. A Chemfax official reported that only two Chemfax final products, stored in two warehouses, were involved in the fire. One warehouse contained Stygene (trade name) which, according to a Chemfax product data sheet, is a range of polynuclear aromatic polymers with a high carbon to hydrogen ratio and no free carbon present. The other warehouse (nearer the highway) contained 5AM Series Resins (trade name). According to a Chemfax product data sheet, these are resins polymerized from olefin hydrocarbons with the elimination of the olefinic double bonds and yielding very low iodine and bromine numbers.

The following substances would likely have been released into the surrounding environment as a result of the explosion and fire:

a. The contents of the reactor which exploded:

(1) nitric acid
(2) sulfuric acid
(3) 2-ethyl hexanol
(4) 2-ethyl hexyl nitrate
(5) possibly reaction intermediates or by-products

b. Thermal breakdown products of the above:

(1) nitric oxide and other oxides of nitrogen
(2) sulfur dioxide and trioxide

c. Contents of other containers and reactors stored on the premises of Plastifax.

A list of chemicals on the Plastifax premises at the time of the explosion was obtained by EPA in conjunction with Plastifax officials. Identification of damaged storage containers indicated that the following materials had been released from their containers as a result of the explosion:

(1) hydrochloric acid
(2) caustic soda
(3) chlorinated paraffins
(4) water softeners
(5) phosphorous acid
(6) hexamethylene tetramine

These chemicals would normally be used for the production of water softening compounds and chlorinated paraffins.

d. Combustion products of the Stygene and 5AM Series Resins.

Discussions with the Chemfax company showed that the following materials may result from combustion or thermal decomposition of these resins:

(1) Carbon monoxide
(2) Carbon dioxide
(3) Oxides of nitrogen
(4) Carbon particles
(5) Aromatic hydrocarbons
(6) Olefinic hydrocarbons

The primary substances known to be released are three acids (hydrochloric, nitric, and sulfuric), 2-ethyl hexanol, and combustion products of Stygene and 5AM Series Resins. Occupational exposure limits and the primary health effects which can result from exposure to these substances are shown in Table 1.

Liquid chemical wastes at the site were tested for pH and compatibility with each other for disposal purposes. However, neither EPA, the State of Mississippi pollution control authorities, nor the clean-up contractor thoroughly analyzed the chemical wastes to identify specific chemical composition. Therefore, for the most part, it was necessary to rely on information provided by Plastifax and Chemfax management officials for chemical identify of substances involved in the explosion, release, and fire.

The explosion of the reactor resulted in a crater at the reactor site which was filled with liquid chemical waste when the emergency subsided and the site was inspected. Both NIOSH and OSHA collected samples of this crater liquid for analysis. The liquid sample was analyzed by gas chromatography/mass spectrometry (GC/MS). The identified chemicals appeared to be chemicals used by Plastifax in the production of chlorinated paraffins and water treatment chemicals. No organic nitrates were detected.

C. Mortality and Morbidity

1. Fatalities.

Of the 14 workers on the Plastifax premises on that day, nine were Plastifax employees, three were from from N.L. Treatment Chemicals (NL), and two from the air-conditioning company. Three men (two Plastifax employees and an employee of the air-conditioning company) were killed primarily by severe traumatic injuries. They also had acid burns to the skin. Two deaths were instantaneous, and one death occurred a short while later at the hospital. These three workers were a short distance away from the reactor at that time. A few workers nearer the reactor were not fatally injured but suffered acid burns to the skin and eyes. Other injuries to the surviving 11 workers included lacerations, rib fractures, eye injuries, and chemical and thermal burns. The main determinant of fatality appeared to be flying metal debris resulting from the explosion.

Nine of the 11 survivors were admitted to a hospital; 8 stayed two or more nights. The two workers who received minor injuries and were not hospitalized were indoors at the time and were therefore protected to some extent from flying debris.

2. Morbidity

Eighty-seven people were seen on the same day at two local hospitals for injuries and symptoms related to the incident. This included 11 survivors from the Plastifax premises, and 76 others from outside the Plastifax premises at the time of the explosion (mainly rescue workers and bystanders). The symptoms were primarily those of upper respiratory tract and conjunctival irritation due to exposure to the chemicals released from the explosion and fire. Nineteen (25%) of the 76 people from outside the Plastifax premises were hospitalized for one or more nights.

D. Personal Interviews

1. Rescue workers

Forty-four rescue workers were interviewed. This included 39 white males (aged 22 to 52 years; mean age 31 years) and 5 white females (aged 22 to 30 years; mean age 25 years). Twenty of them (45%) used some form of respiratory protection. In most instances this consisted of self-contained breathing apparatus (SCBA) with a full-face piece. Eight of these 20 workers (40%) with respiratory protection reported that their breathing apparatus ran out of air while in use, and they then had to dispense with this gear and continued rescue work without respiratory protection. There was no significant differ-

ence in hospitalization rates for rescue workers who used respiratory protection (6 of 24) compared to those who did not (8 of 20) Those with respiratory protection were, however, less likely to have symptoms lasting more than one day (6 of 20) compared to those without such protection (15 of 24). (Chi square = 3.41, $0.05 < p < 0.1$) (Table 3.). The most common symptoms lasting more than a day were cough (34%), eye irritation (25%), and chest discomfort (23%). The most common symptoms reported are shown in Table 4.

Logistic regression analyses were performed with (1)number of symptoms, and (2)hospitalization, as dependent variables, and the following independent variables:

1. Length of time between explosion and arrival
2. Length of time spent in the area
3. Length of time spent on the factory premises
4. No. of times entering the factory premises
5. Use of protective equipment

The two significant findings were that rescue workers who arrived earlier had more symptoms ($p=0.0004$), and those with more symptoms remained in the area for a shorter time ($p=0.0003$).

2. Workers from the two adjacent factories

Of the 25 workers in this group interviewed, there were 19 males and six females. Nineteen were whites and six non-whites. Their ages ranged from 22 to 62 years (mean age = 37 years). The ten workers from Chemfax spent a median time of eight minutes in the area after the explosion. The 15 workers from Hydro-Carbide were evacuated after a median time of 12 minutes. Thirteen workers from both these factories (52%) were symptom-free. The two most common symptoms reported were eye irritation (reported by 36% of those interviewed) and cough (in 28% of those interviewed) (Table 4.). None had any traumatic injuries, and no one in this group needed any medical attention.

3. Residents in the trailer park

The 47 residents interviewed, included 45 whites and two non-whites, aged 13 to 66 years (mean age = 39 years). There were 31 females and 16 males. The modal duration of stay in the vicinity after the explosion was 60 minutes before the residents were evacuated. Two of these residents sought medical attention; one on the same day and another two days later. No one in this group was hospitalized.

Twenty-two residents (47%) were symptom-free. Seventeen (36%) had symptoms lasting a day or less, and eight (17%) had symptoms lasting longer than a day. The most common symptoms reported were headache (36% of residents interviewed), eye irritation (21%), sore throat (21%), and cough (17%) (Table 4.). These were also the symptoms that were reported as lasting more than a day. When those with symptoms lasting more than a day were compared to those who were completely symptom-free, there was no significant difference in the length of time spent in the vicinity (median time of 60 minutes for both groups), in the proportion who were indoors for most of the time following the explosion (88% versus 100%), or in the distance from the explosion site (5/8 mile versus 3/4 mile).

E. Clean-up Worker Protection

The Chemfax Company assumed responsibility for clean-up of the Chemfax fire site. The Chemfax site cleanup was not a part of the EPA Superfund project, and was not reviewed by us.

The Plastifax site surface chemicals and contaminated soil were removed by Superfund authorities. Air monitoring by EPA, the Mississippi Pollution Control authorities, and the contractor, using standard site screening instruments such as the HNU photo-ionizer and the organic vapor analyzer (OVA) found no detectable levels of organic vapors or only small amounts above background levels (Table 2.). Visual inspection of the site revealed only pools of liquid which were presumed to be primarily inorganic acids, and charred debris from the fire. No apparent airborne exposure problem was observed. Nevertheless, the conservative approach to worker protection was taken. All workers inside the contaminated portion of the site were required to wear respirators with dual-purpose cartridges for both organic vapors and acid mists. Because of the obvious hazards from corrosive liquids such as acids, protective measures were concentrated on skin and eye protection. Full face shields were being used for all workers who might potentially be splashed with waste chemicals, and chemical-resistant protective clothing, rubber gloves, and rubber boots with both steel-reinforced toes and shanks were used. Worker protection appeared to be adequate for the substances which were known to be present.

VI. DISCUSSION AND RECOMMENDATIONS

Reviews of the effects of natural and man-made disasters have focused on loss of life, and damage to property, the community, and the environment[1,2]. Immediate and long-term health effects have been documented[3,4,5]. In the investigation of this man-made disaster, we have concentrated on documenting the immediate effects, primarily those on mortality and morbidity. Where warning indicators of an impending disaster exist with an adequate time interval for taking appropriate action, measures to reduce risk factors may minimize or obviate

mortality and morbidity. Glass and co-workers[4], in their study of the 1978 snow disaster in Massachusetts, discussed how early intervention can diminish adverse health consequences of a disaster. In their study of injuries resulting from the 1976 tornado at Wichita Falls, Glass et al[6] identified location in motor vehicles and in frame houses (as opposed to brick houses) as risk factors for injury. Avoidance of these locations would contribute to reduction of injuries. In this investigation at Gulfport, for those on the factory site, location within buildings appeared to protect against injury compared to being outdoors. However, the circumstances of the incident was such that there appeared to be little warning time for workers to take any kind of action to protect themselves from the explosion. If early warning indicators existed showing that the reaction could and was going out of control there may have been adequate time for appropriate effective action to be taken to prevent the incident or reduce its effects.

Morbidity, in terms of hospitalization rates and reported symptoms, occurred more commonly in the rescue workers compared to the occupants of the two adjacent factories or the residents of the trailer park. Symptoms of eye irritation and cough among the rescue workers might be reduced if all such workers were supplied with and used full-face respiratory protection. Those with such protection had fewer symptoms of more than a day°s duration compared to those without. The difference was not however statistically significant. This may be due in part to the air-tanks running out of fresh air supply, resulting in eight out of the 20 workers with respiratory protection dispensing with the SCBA (self-contained breathing apparatus) and continuing rescue work without such protection. The SCBA°s supplied should be checked for an adequate supply of air. When the alarm indicates that the air supply is at a low level while the SCBA is in use, the rescue worker should move out of the incident site to a safe area out of the smoke plume to obtain and switch over to a filled air cylinder. Spare air cylinders should be available to rescue workers involved in such incidents. The training program for rescue workers should be reviewed to ensure that such workers are thoroughly familiar with protective equipment and to know when, how, and for how long these can be used.

For factories involved in similiar chemical reactions, adequate laboratory pre-testing with gradually scaled-up pilot runs before full-scale commercial manufacture, may enable problems with the procedure to be identified at an earlier, smaller-scale stage. The likelihood of explosions of this magnitude would thus be reduced. There should also be proper and adequate supervision of such potentially explosive chemical processes.

Harrison County has a well-prepared disaster plan[7]. The effective coordination and implementation of this plan contributed to the rapid removal of the injured for immediate medical attention. Evacuation of workers in adjacent factories and residents in the trailer park helped to reduce morbidity in these groups. There is a need to review this plan with the experience of this incident in mind. Further improve-

ments may be necessary to better coordinate the activities of volunteer fire-fighters, the regular Gulfport fire-fighters, and other rescue workers.

Three potential occupational safety problems were identified and brought to the attention of the on-scene coordinator:

(1) Because of continuing reaction of liquid chemical wastes, we advised that precautions should be taken in case explosive hydrogen gas was being formed from a reaction of strong acid with metal.

(2) We advised that provisions should be made for rapid eye rinse and flushing of the skin with water in case acids are splashed in the eyes or on the skin of clean-up workers.

(3) EPA Region IV has not developed a generic or model site safety plan for chemical emergency responses[8]. We recommend that such site safety plans should be developed to ensure the safety of clean-up workers at similiar hazardous waste sites.

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IX. DISTRIBUTION AND AVAILABILITY

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Copies of this report have been sent to:

1. Environmental Protection Agency (EPA), Region IV
2. Plastifax Company
3. Chemfax Company
4. N.L. Industries, Inc.
5. NIOSH, Region IV
6. OSHA Region IV
7. Appropriate health and safety agencies of the State of Mississippi

TABLE 1

SUMMARY OF OCCUPATIONAL EXPOSURE LIMITS* AND HEALTH EFFECTS
FOR SUBSTANCES AT THE PLASTIFAX COMPANY EXPLOSION SITE

HETA 82-285

SUBSTANCE	OSHA PEL**	ACGIH TLV***	NIOSH RECOMMENDED STD.	PRIMARY HEALTH EFFECTS	REFERENCE
Contents of the Reactor Vessel Which Exploded					
Nitric Acid	2 PPM	2 PPM 4 PPM STEL	2 PPM	Nasal, lung irritation; corrosive to eyes and skin	9,10
Sulfuric Acid	1 MG/Cu.M	1 MG/Cu.M.	1 MG/Cu.M	Pulmonary irritant; corrosive and irritating to eyes and skin, nose and throat	9,10
2-Ethyl Hexanol	---	---	---	Eye and skin irritation	12
2-Ethyl Hexyl Nitrate	---	---	---	Unknown	
Likely Thermal Breakdown Products of Reactor Contents					
Oxides of Nitrogen Nitrogen Dioxide	5 PPM	3 PPM 5 PPM STEL	1 PPM ceiling (15 minutes)	Pulmonary irritation; lung damage eye, nose, throat irritation	9,10
Nitric Oxide	25 PPM	25 PPM 35 PPM STEL	25 PPM		
Sulfur Oxides Sulfur Dioxide	5 PPM	2 PPM 5 PPM STEL	0.5 PPM	Respiratory effects; irritating to skin, eyes, mucous membrane	9,10,
Sulfur Trioxide	---	---	---		11

SUBSTANCE	OSHA PEL**	ACGIH TLV***	NIOSH RECOMMENDED STD.	PRIMARY HEALTH EFFECTS	REFERENCE
Other Plastifax Chemicals Released					
Hydrochloric Acid (HCL, hydrogen chloride)	5 PPM ceiling	5 PPM ceiling	---	Respiratory irritation; Corrosive and irritating to eyes and skin	10
Sodium hydroxide (Caustic soda)	2 MG/Cu.M	2 MG/Cu.M ceiling	2 MG/Cu.M ceiling (15 minutes)	Airway irritation; Corrosive to eyes and skin	9,10
Chlorinated paraffins (as paraffin wax fume)	---	2 MG/Cu.M 6 MG/cu.M STEL	---	Respiratory irritation; possible nausea, and physical discomfort	13
Phosphoric Acid	1 MG/cu.M	1 MG/cu.M 3 MG/cu.M. STEL	---	Skin and eye burn; skin, eye, nose, throat irritation	10
Hexamethylene Tetramine	---	---	---	Skin sensitizer, skin irritant; respiratory sensitization with asthma-like reaction	14
Possible Combustion Products of Stygene and 5 AM Series Resins at Chemfax					
Carbon monoxide (CO)	50 PPM	50 PPM 400 PPM STEL	35 PPM 200 PPM ceiling	Heart effects; asphyxiation	10
Carbon dioxide (CO_2)	5,000 PPM	5,000 PPM 15,000 PPM STEL	10,000 PPM 30,000 PPM ceiling (10 minutes)	Respiratory effects; asphyxiation	10

SUBSTANCE	OSHA PEL**	ACGIH TLV***	NIOSH RECOMMENDED STD.	PRIMARY HEALTH EFFECTS	REFERENCE
Carbon particles (as carbon black)	3.5 MG/Cu.M	3.5 MG/Cu.M 7 MG/Cu.M STEL	3.5 MG/Cu.M or 0.1 MG/Cu.M in presence of polycyclic aromatic hydrocarbons	Lung and skin effects; cancer risk	9
Oxides of Nitrogen					
Nitrogen dioxide(NO_2)	5 PPM	3 PPM 5 PPM STEL	1 PPM ceiling (15 minutes)	Lung effects	9
Nitric oxide	25 PPM	25 PPM 35 PPM STEL (15 minutes)	---	Lung effects	9
Aromatic hydrocarbons	Limits are given for specific compounds only.			Primary irritants; dermatitis; mucous membrane irritation; central nervous system depression	15
Olefins	Limits are given for specific compounds only.			Low molecular wt.(MW) olefins are asphyxiants; higher MW olefins are anesthetics	15
Polynuclear aromatic hydrocarbons (PNAs)	Exposure limits for PNAs are expressed as benzene-soluble fractions of coal tar pitch volatiles:				
	0.2 MG/Cu.M	0.2 MG/Cu.M	0.1 MG/Cu.M (coal tar products)	lung and skin cancer	9

* Limits are 8-hour time-weighted averages (TWA) unless otherwise stated.
** For OSHA standards, see Reference No. 16
*** For ACGIH TLV's, see Reference No. 17

STEL = short term exposure limit - maximal concentration not to be exceeded during a 15 minute exposure
ppm = parts per million parts of air
MG/Cu. M = milligrams per cubic meter of air

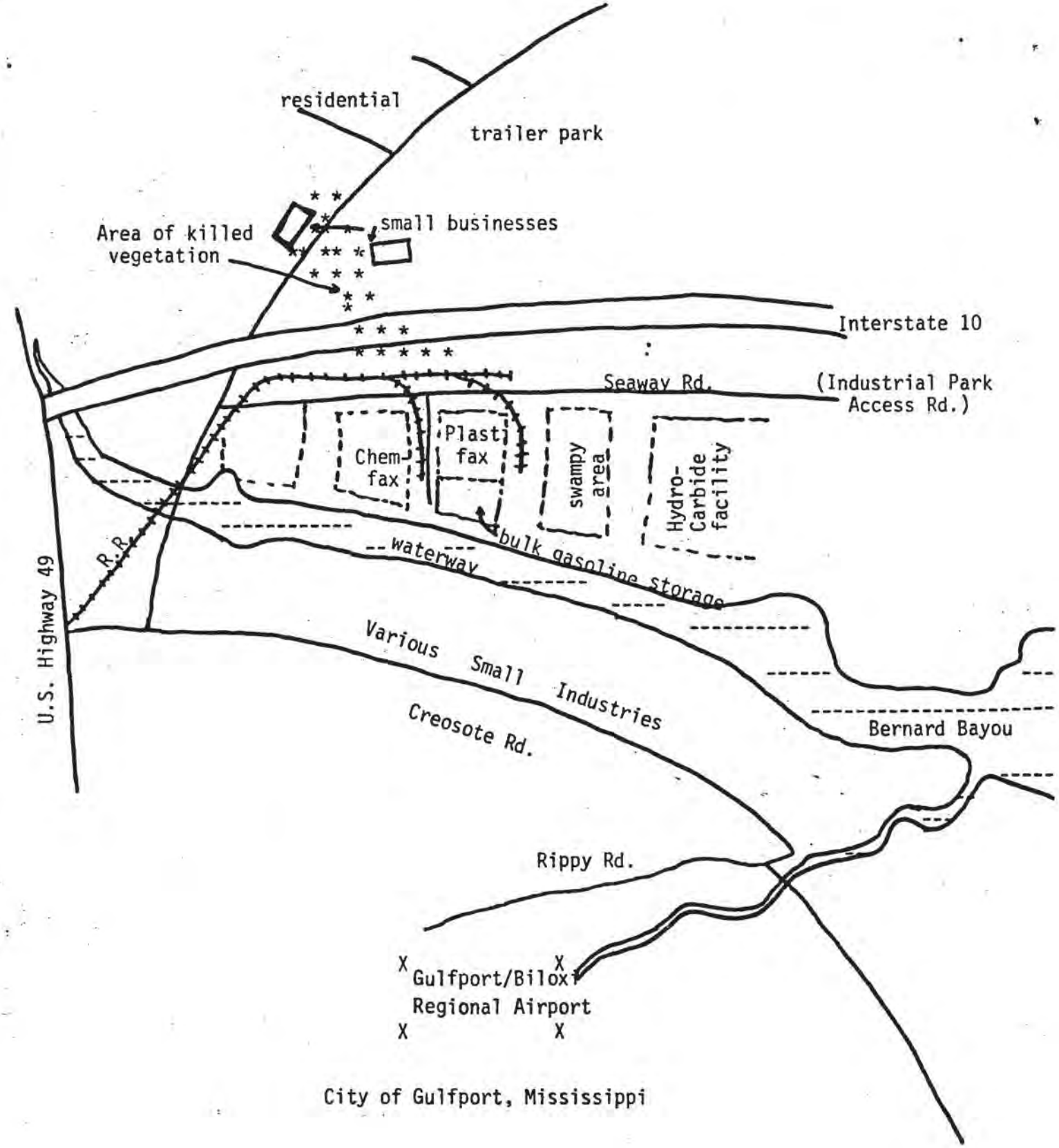

FIGURE 1
Area Diagram

TABLE 2

AIR SAMPLING RESULTS
Supplied by EPA

Plastifax Explosion Site
Gulfport, Mississippi

June 3 - 11, 1982

Date	Sampling Location	Air Contaminant	Concentration	Instrument Used
June 3, 1982	At Coast Guard Command post trailer (outdoors)	Non-specific vapors	40-50 ppm	HNU photo-ionizer
	Plastifax Co. entrance	with high	>60 ppm	"
	1/4 mi E & W of site	ionization	5-8 ppm	"
	Background(away from site)	efficiency	4 ppm	"
June 6, 1982	In Plastifax quality	"	3-11 ppm	HNU & OVA
	control lab on the site	"	2-3 ppm	HNU & OVA
	Background (away from site)	"	2 ppm	HNU & OVA
June 7, 1982	At command Post	Nitric acid	1.5 ppm	Drager Tubes
	At trenches	Nitric acid	1.5 ppm	Drager Tubes
	On Plastifax site	Nitric acid	1.2 ppm	Drager Tubes
	At worker rest station	Nitric acid	2 ppm	Drager Tubes

OVA means Organic Vapor Analyzer
ppm means parts of gas or vapor contaminant per million parts of air, by volume

TABLE 3.

DURATION OF SYMPTOMS IN RESCUE WORKERS

Plastifax Explosion Site
Gulfport, Mississippi

HETA 82-285

	NO. OF RESCUE WORKERS WITH			TOTAL
	NO SYMPTOMS	SYMPTOMS LASTING ONE DAY OR LESS	SYMPTOMS LASTING MORE THAN ONE DAY	
WITH RESPIRATORY PROTECTION	1	13	6	20
WITHOUT RESPIRATORY PROTECTION	2	7	15	24
TOTAL	3	20	21	44

TABLE 4.

SYMPTOMS EXPERIENCED BY THOSE INTERVIEWED

Plastifax Explosion Site
Gulfport, Mississippi

HETA 82-285

SYMPTOMS	RESCUE WORKERS	WORKERS FROM ADJACENT FACTORIES	RESIDENTS
1. COUGH	64%	28%	17%
2. HEADACHE	59%	12%	36%
3. EYE IRRITATION	57%	36%	21%
4. NAUSEA	48%	12%	13%
5. CHEST DISCOMFORT	45%	16%	2%
6. DYSPNEA	39%	12%	9%
7. SORE THROAT	30%	16%	21%
8. SKIN IRRITATION	25%	0%	11%
9. WHEEZE	18%	12%	6%
10. EFFECTS OF TRAUMA	0%	4%	0%