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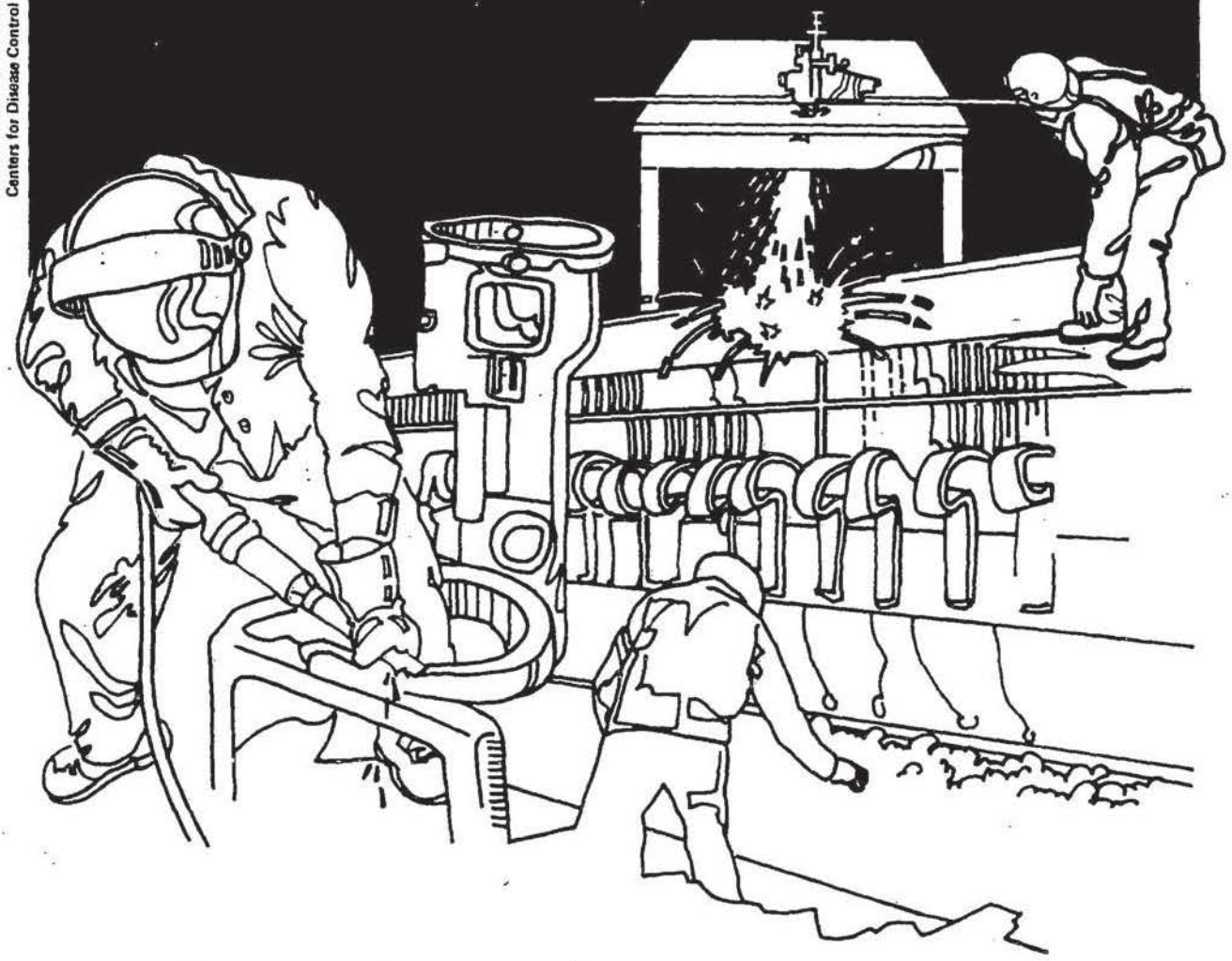

Health Hazard Evaluation Report

HETA 83-230-1530
ORANGE COUNTY FIRE DEPARTMENT
ORLANDO, FLORIDA

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 83-280-1530
NOVEMBER 1984
ORANGE COUNTY FIRE DEPARTMENT
ORLANDO, FLORIDA

NIOSH INVESTIGATOR:
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I. SUMMARY

In May 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Association of Fire Fighters to evaluate the potential health hazards to firefighters from the Orange County Fire Department in Orlando, Florida, responding to a fire involving burning pesticides at a nursery warehouse on May 5, 1983.

Between August 23 and 25, 1983, a NIOSH investigator administered a medical questionnaire to six of eight firefighters and two of three exposed civilians. Reported post-fire symptoms included skin and eye irritation (each reported by 3 persons); chest tightness, swelling of the face, stomach cramps, and sore throat (2 persons each); and shortness of breath, upper respiratory irritation, cough, nausea, bad taste in the mouth, numbness in the fingers, and numbness in the lips (1 person each). All symptoms had subsided by the time of the survey (three months after the fire). Medical records noted symptoms comparable to those reported on the NIOSH questionnaires, and diagnoses of smoke and chemical inhalation. Blood gases, chest X-rays and routine blood tests revealed no abnormalities attributable to exposures at the fire.

Based on the information collected during this survey, firefighters experienced acute illness, apparently caused by smoke and chemical inhalation at the nursery warehouse fire on May 5, 1983. Recommendations concerning protective measures, medical surveillance and planning for potential future exposures are made in Section VII of this report.

KEYWORDS: SIC 9224 (Fire protection), firefighters, smoke inhalation, chemical inhalation, pesticide fire

II. INTRODUCTION

In May 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Association of Fire Fighters for a health hazard evaluation at the Orange County Fire Department in Orlando, Florida. The request asked that NIOSH evaluate the potential health hazard to firefighters exposed to burning pesticides at a nursery warehouse fire on May 5, 1983, review their medical records, and make recommendations concerning future treatment for these firefighters.

The Orange County Fire Department was notified of the request in a letter dated July 11, 1983. NIOSH was informed in a letter dated August 11, 1983, from Orange County's legal consultant, that county and fire department officials declined to participate in the study.

On August 23-25, 1983, a NIOSH medical investigator visited Orlando, Florida to collect information and interview firefighters.

III. BACKGROUND

The Orange County Fire Department was formed in 1981 when 16 separate districts were combined together to form one country-wide agency. Prior to that, there were some areas of the county that were serviced by volunteer firefighters only. Currently, the fire department consists of 23 separate stations, each having between six and 18 firefighters covering three shifts.

The following summary of the events, occurring on May 5, 1983, at a nursery warehouse fire, is based on the written statements of six firefighters who fought that fire. NIOSH requested a summary of the events from the Orange County Fire Department in a letter dated September 22, 1983. The fire department did not provide this information.

On May 5, 1983, at approximately 10:15 p.m., Engine 84, a two-person unit, responded to a reported structure fire at a nursery warehouse. There was no pre-fire plan for the nursery, which means that the responding firefighters were not aware of the burning building's type or contents. Upon arrival, the firefighters saw a 20' x 30' wood frame warehouse totally engulfed in flame. Three civilians were in the process of fighting the fire with ordinary garden hoses.

Engine 84 waged an outside attack on the fire. About 30 minutes later, Engine 82 and tanker 82 arrived with two firefighters, along with Rescue 80, a two-person unit. Soon after the arrival of these additional firefighters, the crew was informed that several chemicals were contained in the building. At that point, firefighters were instructed to use self-contained breathing apparatus (SCBA). The

Chief, who was in route to the fire, was notified by radio of the chemical hazard. Upon his arrival on the scene, he ordered the crew to remove the roof and asked the nursery owner to compile a list of chemicals in the warehouse.

The firefighters who were first on the scene and a civilian began experiencing chest tightness, shortness of breath, abdominal cramps, nausea, and burning eyes, nose and throat. Shortly thereafter, Rescue 80 transported four firefighters and two civilians to a local hospital emergency room. About two hours later, the remaining crew members went to the same emergency room.

On Sunday, May 8, three firefighters reported back to work. They said that according to the local emergency room, they should be seen by a doctor for follow-up, and on the morning of May 9 they were sent to the county's contract industrial medical clinic to be seen by a physician. They returned later in the day with a recommendation from the nurse that they return to work. These three, along with the other three firefighters involved in the warehouse fire, were sent back to the clinic later in the afternoon to see the physician. (These latter three additional firefighters did not go for a first, earlier visit to the clinic because they had not returned to work at that time.) The physician performed a brief physical examination (checking eyes, ears, nose, throat, heart, and lungs) and recommended that they return to work. Three firefighters felt that they were still ill and were dissatisfied with the evaluation. On that same day, those three firefighters sought another medical opinion, from an outside physician, and were told that firefighters exposed to burning pesticides and chemicals should undergo pulmonary function tests; blood tests, including cholinesterase; and a second blood gas analysis before returning to duty. The county's contract clinic was informed of the outside physician's opinion, and subsequently all firefighters exposed at the fire were given blood tests, including serum cholinesterase.

IV. EVALUATION DESIGN AND METHODS

There were two major objectives in the investigation. The first was to characterize exposures and adverse health effects among the firefighters who attended the nursery warehouse fire, and the second was to make some recommendations regarding treatment and surveillance for these and other firefighters similarly exposed in the future.

A questionnaire was administered to six of the eight firefighters at the scene and to two of the three civilians who initially fought the fire. The questionnaire was designed to collect information on work history, medical history, smoking, and alcohol use; on exposures at the fire; and on recent health effects.

The firefighter's medical records were sought from three sources: the local emergency room where they went on the night of the fire; a local medical testing facility, where blood tests were done several days after the fire; and the industrial medical clinic used by Orange County to serve county employees.

V. EVALUATION CRITERIA

Thermal decomposition products and toxic substances expected to have been present in the nursey warehouse fire on May 5, 1983 are shown in Table 1. Since the warehouse contained several different pesticides, determination of specific exposures and characterization of the risks from those exposures would only be speculation. The combustion products produced from burning structures contain toxic fumes and gases. The fact that pesticides were involved in this fire only amplifies the hazard.

Firefighters exposed to pesticides at a lawn and garden center warehouse fire in 1977 [1] reportedly experienced shortness of breath, nausea, and dizziness requiring subsequent medical treatment. There was no further information as to whether any of these firefighters have since developed any chronic injury associated with their exposures.

Little information is currently available concerning delayed behavioral and physiological effects of acute exposures to pesticides. However, many pesticides are particularly toxic to the nervous system. For example, the organophosphate pesticides act as irreversible inhibitors of the enzyme cholinesterase, thereby allowing the accumulation of acetylcholine at nerve endings. Mild organophosphate poisoning causes headache, fatigue, dizziness, blurred vision, excessive sweating, nausea, vomiting, stomach cramps, diarrhea, and salivation. Symptoms are normally noted within 12 hours after exposure. Carbamates are reversible cholinesterase inhibitors. Like organophosphates, they may be direct or delayed in action.

Recent studies [2,3] conducted by NIOSH have demonstrated a high prevalence of respiratory symptoms in firefighters after fighting major fires at a chemical warehouse and a hotel. NIOSH researchers are currently evaluating the long-term consequences of exposures at a chemical dump fire in New Jersey. Residual lung injuries, resulting in reduced pulmonary function, have been detected in some firemen for up to three months after an exposure to burning polyvinyl chloride plastics[4].

The use of a NIOSH-approved self-contained breathing apparatus, equipped with a positive pressure regulator, is absolutely essential to prevent these serious, potentially life-threatening exposures. Since July 1, 1983, in many states firemen assigned to either municipal or volunteer fire departments must wear positive pressure breathing apparatus when performing interior structural firefighting.[5] This regulation, however, applies only to private sector or industrial fire departments in states which do not have an OSHA- approved state plan. Only state plans provide OSHA protections to employees of public agencies.

VI. RESULTS

A. Questionnaire results

The eight exposed persons interviewed (six firefighters, two nursery personnel) were all white males ranging in age from 24 to 40 years. The firefighters' length of employment ranged from two to 18 years, with a mean of 8.5 years. All the firefighters reported holding part-time jobs while employed at the fire department, but none of these jobs involved any apparent hazardous chemical exposures. One reported having fought in a chemical fire in 1982, prior to the nursery warehouse fire, but had suffered no known chronic adverse health effects as a result. None of the interviewees reported any past hazardous chemical exposure or any significant past health problems. One of the firefighters smoked about one pack of cigarettes a day, and all reported alcoholic beverage consumption in the range of 6-20 beers per week and 0-7 mixed drinks per week.

The symptoms reported by the interviewees were varied. They included skin and eye irritation (each reported by 3 persons); chest tightness, swelling of the face, stomach cramps, sore throat (2 persons each); and shortness of breath, upper respiratory irritation, cough, nausea, bad taste in the mouth, numbness in the fingers, and numbness in the lips (1 person each). The duration of these symptoms ranged from one day (eye irritation) to three months (cough). The reported exposure time ranged from 30 minutes to two hours. Four of the six firefighters reported wearing a respirator while on the scene, but only one wore it during the entire firefighting period. The type of firefighting reported included close-in firefighting from start to finish (one person), close-in firefighting with exposure to the spray of an exploding barrel of chemicals (1); manning the water tanker, presumably involving limited chemical exposure (1); limited direct firefighting (2); limited outside firefighting plus inside roof removal (2); and outside roof removal (1).

B. Medical Records Review

At the emergency room, six persons were diagnosed as having chemical and smoke inhalation. Two had conjuctivitis. Five of the firefighters had chest X-rays, and four of six had arterial blood gas analyses. None of these tests revealed any abnormalities. Treatment provided to the firefighters included flushing the eyes, steroids (for bronchial swelling), and antibiotics (for potential infection). All six firefighters were released and told to have a follow-up examination in two days; one was told to see a pulmonary specialist. A battery of routine blood tests done five days later showed no abnormalities except for a slight elevation of one liver enzyme in one individual. The Orange County Fire Department refused to authorize release of the firefighters' individual medical records from the contract clinic, and the clinic's physician refused to provide any information.

VI. CONCLUSIONS

Orange County firefighters who fought the May 5, 1983 nursery warehouse fire apparently experienced symptoms related to smoke and chemical inhalation during the fire. All symptoms subsided within three months of the exposure, but there is limited information concerning the chronic long-term effects of such exposures.

VII. RECOMMENDATIONS

1. Firefighters should not enter burning structures unless properly protected with NIOSH-approved SCBAs operated in a positive pressure mode and with other appropriate protective equipment.

2. Prefire planning, which involves compiling a list of flammable and toxic substances used and stored at all businesses serviced by the fire department, should be done to provide firefighters with necessary information, prior to firefighting, so they can effectively prevent injury to their health and protect the environment during a chemical or pesticide fire.

3. In addition to CHEMTREC, toxicity information on pesticides can be obtained from the Environmental Protection Agency's (EPA) "Pesticide Clearinghouse". Their toll-free phone number is 800-399-5352. These sources can provide valuable assistance and recommendations for fire control, protective measures, and decontamination procedures for the chemicals or pesticides involved in a fire.

4. Under certain situations, the hazards of exposure from a pesticide fire may be sufficient to justify minimizing firefighter's exposures. Conventional turnout clothing may not provide adequate protection form pesticide contaminated smoke, mist, and run-off water.

5. Local environmental protection agencies should be notified immediately of the possibility of contamination of ground or surface water. All run off water should be contained with an earth berm and later removed in accordance with applicable EPA and Department of Transportation regulations.

6. All contaminated equipment should be properly cleaned or disposed of in a timely manner to prevent unnecessary exposure.

7. A medical surveillance program should be implemented for all fire fighters. The program should include: (1) periodic assessment of cardiac and pulmonary function through medical histories, physical examinations, and - depending on age, time since last evaluation, medical history, and physical examination findings - pulmonary function tests, an electrocardiogram, and other appropriate diagnostic procedures; (2) audiometric tests; and (3) vision testing. Pulmonary function tests, audiometric tests, and vision tests are essential for the preplacement examinations in order to establish baselines with which to which subsequent tests can be compared. Special examinations should be available after a fire that involves known or suspected exposures to toxic substances. This should include cholinesterase levels after a fire involving pesticides.

VIII. REFERENCES

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5. U.S. Dept. of Labor, Occupaional Safety and Health Administration (OSHA), Title 29 CFR 1910.156: Occupational Safety and Health Standards--Fire Protection; Means of Egress; Hazardous Materials. Federal Register, Vol. 45, No. 179, Sept. 12, 1980.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. International Association of Fire Fighters
2. Orange County Fire Department
3. NIOSH, Region IV
4. OSHA, Region IV

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table I

Suspected Toxic Products
Released from Combustion of Pesticides and other
materials in Warehouse Fire

Substance	Combustion Products
polyvinyl chloride	hydrogen chloride (principal product), carbon monoxide*, chlorine, phosgene (from electrical fires), aldehydes
pesticides: organophosphates carbamates chlorinated compounds	chlorine, carbon monoxide*, hydrogen cyanide, hydrogen sulfide, nitric acid, ammonia,

Other toxic products form structural fires

Substances Containing:	Combustion Products
carbon and hydrogen (hydrocarbons)	carbon dioxide, carbon monoxide*
carbon, hydrogen, & oxygen (wood, cellulose)	carbon monoxide*, aldehydes, formaldehyde
carbon, hydrogen, oxygen and nitrogen (silk, wool, nylon)	hydrogen cyanide
rubber and asphalt	polynuclear aromatic hydrocarbons (PNAs)
cellulose nitrate	nitrogen dioxide
polystyrene	styrene vapor*

COMMENT - A primary hazard in fighting any pesticide fire is the potential for inhalation and skin adsorption of non-decomposed pesticide vapors and liquids mixed with steam and smoke. Special consideration must also be given for containment of contaminated run-off water and decontamination of protective clothing and fire fighting equipment after the fire is brought under control.

*Responsible for the majority of deaths in building fires

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