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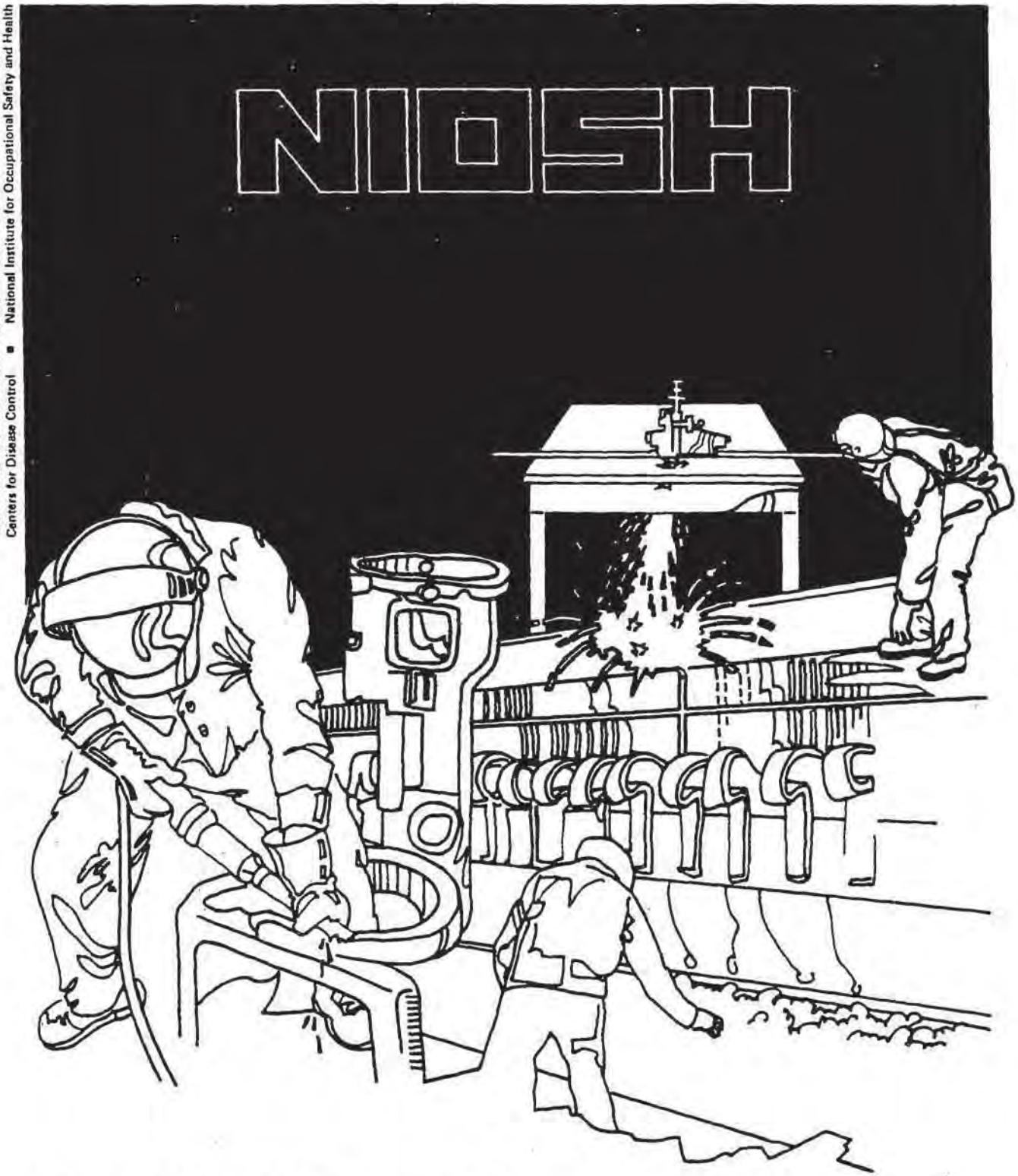

Health Hazard Evaluation Report

HETA 81-137-990
FEDERATED FIRE FIGHTERS OF NEVADA
LAS VEGAS, NEVADA

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 81-137-990
NOVEMBER 1981
FEDERATED FIRE FIGHTERS OF NEVADA
LAS VEGAS, NEVADA

NIOSH INVESTIGATOR:
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I. SUMMARY

On November 22, 1980, a fire occurred in the MGM Grand Hotel in Las Vegas, Nevada. Approximately 400 firemen from Las Vegas and surrounding counties were involved in fighting the fire. A considerable number of fatalities were caused by the fire, although none among firemen. In December 1980, NIOSH was requested to evaluate the possibility that the fire may have led to lasting adverse health effects among the firemen. The request, which was submitted by the Federated Fire Fighters of Nevada through the International Association of Fire Fighters, stated that firemen were still, several weeks after the fire, experiencing respiratory and other symptoms and that these symptoms may have been caused by exposure to smoke and fumes during the fire. The request also stated that firemen had suffered untoward psychological effects due to the great number of fatalities and that these effects warranted evaluation.

In response to the request a medical survey was performed in Clark County on January 15-20, 1981. A questionnaire concerning acute and persisting health effects and psychological trauma associated with fighting the fire was completed by 356 of the fire fighters who attended the fire. Medical information regarding diagnosis for hospitalized fire fighters as well as cause of death for the fatalities associated with the fire were obtained.

The surveyed fire fighters reported a high prevalence of upper respiratory tract symptoms, increased irritability, and sleep disturbances. At the time of the interview, 38 % reported one or more physical symptoms, and 50 % reported one or more psychological symptoms. Although the prevalence of health effects, in particular respiratory tract symptoms, was considerably higher during the three days immediately after the fire, many of the symptoms persisted for several weeks. To a certain extent the symptoms probably reflect the long-term health effects of the repeated periods of exposure to hazardous concentrations of smoke and fumes that fire fighters experience and also the high level of stress that characterizes their occupation.

The results of this survey show that a large proportion of the fire fighters suffered acute effects due to exposure to smoke and fumes. The persisting symptoms, both physical and psychological, that some of the fire fighters were experiencing at the time of the survey, may also have been due to this exposure. However, the persisting symptoms are more likely caused by the accumulated effects of several years repeated exposure to high levels of smoke and fumes and to a certain extent attributable to the the psychologically demanding nature of the job.

Recommendations pertaining to this investigation are presented in Section VII of this Report.

KEY WORDS: SIC 9224, fire fighters, stress,

II. INTRODUCTION

On December 28, 1980, NIOSH was requested to evaluate possible lasting adverse health effects among the approximately 400 firemen involved in a large hotel fire in Las Vegas, Nevada, in November, 1980. The request, which was submitted by the Federated Fire Fighters of Nevada, through the International Association of Fire Fighters, stated that firemen were experiencing respiratory and other symptoms and that these symptoms may have been caused by exposure to smoke and fumes during the fire. The request also stated that firemen had suffered untoward psychological effects due to the great number of fatalities and that these effects also warranted evaluation.

An Interim Report pertaining to this evaluation was issued in February 1981.

III. BACKGROUND

The MGM Grand Hotel, one of the largest in Las Vegas, was built in 1972. It has 26 stories and 2000 rooms. The lower levels, where the fire started, were occupied by casino, restaurant and showroom facilities. The fire is considered to have been caused by electrical discharge in one of the restaurant areas. After smoldering for several hours, it suddenly erupted and spread very rapidly through the lower levels of the hotel and to the above stories through stairwells and elevator-shafts. High concentrations of smoke and fumes spread through-out the entire building. The fire lasted approximately 3 hours.

The extensive use of plastics and other synthetic building and decorative materials caused the conflagration to be extremely intense and hot and presumably produced toxic air contaminants, such as hydrogen chloride, hydrogen cyanide, acrolein and carbon monoxide. 84 persons, mainly guests and employees succumbed to the fire.

Due to the extent and duration of the fire and the number of firemen involved, air packs or other adequate respiratory protection devices were not used to the extent warranted by the high concentrations of smoke and fumes.

IV. EVALUATION DESIGN AND METHODS

In January 1981, a NIOSH medical epidemiologist visited Las Vegas in response to the request. The investigation was initiated using a self-administered questionnaire to elicit the prevalence and character of the health effects and symptoms firemen had experienced during the first few days after the fire and also what health effects they were still suffering from. Information was also sought concerning psychological effects and state of mood, using the Profile of Mood States (POMS) score(1), an inventory scale designed to measure identifiable moods or affective states.

The POMS was initially designed for the assessment of psychiatric outpatients, but other comparison data have been amassed from repeated administration of the POMS set of questions to college students. A high POMS score indicates that the individual is expressing a high degree of the emotional state being measured.

The questionnaires were analyzed to detect possible correlation between prevalence and character of health effects and exposure measures, such as time spent at the fire. The prevalence and severity of psychological effects, as measured by the POMS questions, were also determined and correlated with other health effects.

Detailed medical information concerning the hospitalized firemen was obtained and studied. Efforts were made to obtain results of the medical testing, including the blood gas analysis, performed on other persons exposed to smoke and fumes. However, these results and the results of the environmental sampling have not yet been made available and are not evaluated in this report.

Interviews with representatives of the requesting union and with the health and safety representative of the fire department provided further information concerning reported immediate and lasting health effects among firemen, and information regarding health effects experienced by other persons exposed to the fire and the cause of death among the deceased.

V. EVALUATION CRITERIA

GENERAL

According to available statistics, fire fighting is the most hazardous profession in the United States. As a cause of occupational mortality and morbidity it out-ranks other high-risk professions such as mining and construction. A considerable proportion of these effects are due to the high incidence of trauma, including severe burns and acute smoke inhalation, which is a common cause of injury and death among fire fighters. Effective respiratory protection is available but usually not in sufficient quantities, especially during extended or large conflagrations.

Apart from acute effects, there is an increasing recognition of the fact that repeated incidents of exposure to high levels of smoke and fumes, such as fire fighters may experience, can cause chronic disease and other lasting health problems. These effects occur mainly in the respiratory system, and can result in debilitating conditions, such as chronic bronchitis and/or emphysema. Even in fire fighters with no signs of overt pulmonary disease it is common to find decreased pulmonary function as measured by spirometry.

The respiratory effects, both acute and chronic, are mainly caused by irritating gases, for example nitrogen dioxides. Although these gases are also produced by thermal decomposition of common organic substances, it is possible that the increased use of synthetic building materials has led to higher levels of previously uncommon, highly irritating gases, such as formaldehyde, phenol, and hydrogen chloride.

In addition to respiratory effects fire fighters may also be exposed to toxic substances, which can cause hematologic, neurologic and liver function disturbances. These toxins can be produced by pyrolysis, such as benzene and toluene, but can also have been present prior to the fire, for example in chemical waste dumps and pesticide ware-houses. In the latter situation the fire may cause destruction of containers with subsequent toxic contamination of the environment in which the fire fighters work.

The fire fighter profession is characterized by periods of intense work interspersed with periods of relative inactivity. This in combination with the significant risk of bodily injury and accidents probably leads to high levels of stress and other untoward psychological effects among fire fighters. Due to the considerable prevalence of obvious physical health problems, these psychological effects tend to be overlooked.

SPECIFIC

Stress

Epidemiologic studies of occupational groups with high levels of stress have indicated that severe stress is associated with increased risk of cardiovascular disease, especially in occupational groups suffering a combination of high job demands and low decision latitude or environmental constraints[6,7]. While high levels of job demand are undoubtedly characterstic of the fire fighter profession, it has not been determined to what extent they also are subjected to low levels of decision latitudes or environmental constraints.

Survivors of natural disasters often suffer emotional problems that may range in severity from sleep disturbances to signs of overt psychosis[8,9,12]. It has been recognized that these effects may be somewhat reduced by treatment in the form of supportive counseling and it is likely that this treatment should be instituted as soon as possible after removal from the area of danger[12]. Fire fighters are often the first to have contact with survivors of fires and other disasters and may thus be required to perform with considerable emotional stability also when exposed to serious physical hazards. This may add to the already considerable stress experienced by these rescue workers since they must not only deal with the psychological consequences of the risks that they are exposed to but they must also be prepared to offer emotional support to survivors.

Ability to perform efficiently under severe psychological and emotional strain is also important in situations where rescue workers, due to the magnitude of the disaster, are limited to offering directives to persons in the disaster area[13,14]. There are indications that, especially in fires, correct behaviour on the part of the persons at risk may reduce fatalities and it is consequently important that fire fighters are prepared to and capable of influencing the behaviour of persons at risk.

All this places great demands upon the emotional stability and state of mental preparedness of fire fighters and it is therefore likely that this occupational group would benefit from preventive counseling and other such measures designed to help them cope with the particular stressors of their occupation that can not be removed or reduced by environmental modification.

Toxins

Conflagrations in modern buildings cause the release of thermal decomposition products of various plastics and other man-made construction materials in addition to commonly occurring products of pyrolysis such as carbon monoxide. The chemical nature of the gases and fumes released depend upon the composition of the burning materials and also the temperature of the fire. Complete combustion, which usually requires temperatures of at least 2500° F, commonly results in less toxic end products than those released by combustion at lower temperatures.

The following section will describe the more prevalent of the hazardous products caused by thermal decomposition of plastics and other building materials.

Carbon Monoxide[2]

An important cause of death in association with fires is the inhalation of carbon monoxide (CO), a colorless, odorless gas that results from the incomplete combustion of various carbonaceous compounds.

The toxic effects of CO are due to its high affinity for the oxygen transporting elements of the blood. Since this affinity is higher than for oxygen, CO replaces oxygen and thereby blocks the transportation system for oxygen in the body.

Inhalation of high concentrations of CO usually result in death or very severe brain damage. Intermediate concentrations may cause irreversible brain damage, whereas prolonged exposure to low concentrations has epidemiologically been associated with the development of atherosclerosis and heart disease.

Nitrogen Oxides[2]

Various nitrogen oxides (N_xO_y) are released by thermal decomposition. At sufficient concentrations they cause eye and mucous membrane irritation and if dissolved in water produce nitric acid, an extremely corrosive liquid which causes severe burns and ulcers.

High concentrations of nitrogen oxides can result in severe pulmonary irritation and methemoglobinemia followed by pulmonary edema. Prolonged exposure may lead to emphysema.

Phenol[2]

Phenolic resins are relatively intert but are decomposed by heat to yield products including phenol and formaldehyde. Phenol (C_6H_5OH) has a marked corrosive effect on all tissues and if not removed promptly may cause severe burns. The systemic effects are serious and include shock, cyanosis and kidney damage.

Formaldehyde[2,3]

The plastics melamine-formaldehyde and urea-formaldehyde begin to decompose after 30 minutes at 350° F with the release of formaldehyde vapors. Formaldehyde (HCHO) is a colorless, pungent gas which causes severe mucous membrane and eye irritation.

Inhalation of formaldehyde gas has also been reported to cause urticaria. Systemic intoxication at high concentrations is unlikely to occur since intense irritation of upper respiratory passages compels workers to leave areas of exposure. However, if inhalation of high concentrations does take place, it results in coughing, breathing difficulties and pulmonary edema. Carcinogenic properties have been determined in studies of laboratory animals exposed to fromaldehyde.

Hydrogen Chloride[2]

Hydrogen chloride (HCL) is a gas, the aqueous solution of which is known as hydrochloric acid. It can be released through pyrolysis of polyvinylchloride (PVC), a very common type of plastic. Both the acid and the gas are in high concentrations extremely corrosive to eyes, skin, and mucous membranes, and can cause burns, ulcerations and dermatitis. The irritant effect of the vapors on the respiratory system may produce laryngitis, glottal edema, bronchitis, pulmonary edema, and death.

Hydrogen Cyanide(2,3)

Inhalation of large doses hydrogen cyanide (HCN), a gas caused by thermal decomposition of acrylonitrile, causes death by asphyxiation through inactivation of certain enzyme systems that are essential in the cellular respiratory process. The main symptoms are loss of consciousness and cessation of respiration. Lower levels of exposure may cause weakness, headache, confusion, nausea, and vomiting. Local effects of exposure to hydrogen cyanide are mainly mild upper respiratory tract and eye irritation.

Acrolein(2)

Thermal decomposition of propylene produces acrolein (H_2C=CHCHO), a compound with pronounced mucous membrane irritating properties. Skin burns and dermatitis result from prolonged exposure. Due to its pungent, offensive odor and intense irritation of eyes and upper respiratory tract, severe effects from acute exposure are rare, as the vapors are not tolerated even in minimal concentrations. Acute exposure may, however, cause bronchial inflammation, resulting in bronchitis and pulmonary edema.

Polymer-Fume-Fever(3)

Polytetrafluoroethylene (PTFE, Teflon^R) presents a special thermal decomposition hazard, called Polymer-Fume-Fever (PFF). As with Metal-Fume-Fever the presenting clinical symptoms characteristically develop a few hours after exposure to PTFE pyrolysis fumes.

The initial symptoms consist of chest-discomfort and dry cough. Subsequently occurring systemic symptoms include increased body temperature, increased puls rate, sweating, and chills. Recovery takes place fairly rapidly and is usually complete within two days. The specific agent responsible for PFF and the mechanism involved are unknown.

VI. EVALUATION RESULTS AND DISCUSSION

Approximately 35 firemen sought medical care during and after the fire. Fifteen were hospitalized for periods of one day up to two weeks, mainly due to the effects of smoke inhalation. At least three firemen were still receiving medical care at the time of the survey, which took place two months after the fire.

About 650 other persons, guests and employees, were examined and treated at hospitals and other medical facilities. Blood gases were drawn on the majority of these persons. Of the 84 victims of the fire, 75 were considered to have died from smoke and carbon monoxide inhalation, the cause of death among the others being trauma and burns.

Approximately 400 fire fighters were involved with the fire, all these were provided with questionnaire forms of which 356 were returned. All respondents were male, their ages ranged from 23 to 68 with a median of 27. Current cigarette smoking was reported by 36 % of the respondents. Smokers had a higher median age than non-smokers and had also worked longer as fire fighters. The number of years worked as fire fighters ranged from 0 to 30 with a median of 8 years. The time spent at the scene of the fire ranged from 0 - 80 hours with a median of 8 hours.

Only 7 % of the respondents reported using a respirator all the time that they were exposed to smoke and fumes and 60 % reported not using respirators at all while at the scene of the fire. In regard to exposure measures, such as hours spent at the fire and respirator usage, smokers and non-smokers were similar.

Nose and throat irritation, lasting for at least 3 days following the fire, was reported by 47 % of the respondents and cough during the same time period by 42 %. Other symptoms and health effects were less common. The results are summarized in Table 1.

At the time of the interview, two months after the fire, cough was the most common symptom, reported by 20 %, whereas 26 % reported "other health effects". The "other health effects" were in most cases described verbally, these descriptions covered a wide range and no indication of commonly occurring symptoms that could have been related to exposure to the fire was detected. The symptoms reported at the time of the interview are summarized in Table 1. The prevalence of fire fighters with multiple physical symptoms at the time of the interview is shown in Table 5.

Increased irritability and sleeping difficulties were reported by 28 % of the fire fighters, and 8 % reported that they were still, at the time of the interview, suffering from the psychological trauma that they had experienced during the fire. These symptoms were highly correlated with the POMS inventory scale. The average POMS scores among the fire fighters were lower than scores obtained among college students, which could indicate that that the available referent group was unsuitable. The results of the questionnaire items dealing with psychological factors and the POMS scale are summarized in Tables 2 and 3. The prevalence of fire fighters with multiple psychological symptoms at the time of the survey is shown in Table 5.

In 1980 NIOSH performed an evaluation of fire fighters in Alliance, Ohio[4], who in 1974 had been exposed to a pesticide fire and subsequently had developed psychological problems. The evaluation included psychological effects, measured by the POMS score, as well as physiological effects determined through interviews. For comparison purposes it also included a reference group comprised of non-exposed fire fighters.

The groups were quite small and not matched on demographic variables but there appeared to be a consistent positive association between both presence of physical health problems and exposure to the pesticide fire and extreme POMS scores. The results are summarized in Table 6. The mean POMS scores in the reference group were similar to the mean scores in the group of Clark County fire fighters with no physical symptoms. However, the reference group used in the Alliance investigation was small, only 24 individuals, and may have been different from the Clark County fire fighters in many respects that could affect the POMS scores.

While there is definitely an association between exposure to the fire and acute symptoms during the days following the fire it is more difficult to determine whether this association persists for symptoms reported at the time of the interview, two months after the fire. This is mainly due to the lack of a non-exposed but in other respects comparable reference group. In order to study a possible dose-response correlation attempts were made to separate the total study population into groups with high and low exposure. The only measures of exposure available in the analysis were hours spent at the fire and respirator usage, the assumption being that persons that spent a long time at the fire or that did use respirators probably had higher exposure than others. However, both these parameters may be confounded by the fact that severely exposed persons may have left the scene of the fire after short time, due to development of symptoms, and that persons using respirators may have been protected against smoke and fumes. Conclusions regarding the data must be made bearing this in mind.

In the data collected there appeared to be no significant correlation between measures of exposure, such as time spent at fire or hours of respirator usage, and prevalence of health effects and symptoms either during the three days after the fire or at the time of the interview.

Cigarette smokers reported both higher prevalence of shortness of breath and higher prevalence of extreme mood scale scores as well as increased prevalence of sleep disturbances and irritability. The differences between smokers and non-smokers are shown in Tables 1 and 4. There was also a strong correlation between psychological indicators and reported health effects, mainly respiratory symptoms. These results may reflect an increased susceptibility on the part of smokers to both physical and psychological trauma, and that persons with physical health effects may be more likely to experience psychological problems.

NIOSH is currently conducting a follow-up study of close to 400 fire fighters involved with a chemical dump fire in Elizabeth, New Jersey[5]. As part of the study, the Elizabeth fire fighters responded to a questionnaire regarding prevalence of respiratory and other health problems that they were experiencing several months after exposure to the fire. The responses to this questionnaire indicate a slightly higher prevalence of respiratory tract symptoms among the Elizabeth fire fighters than among those surveyed in Clark County. Differences in smoking habits, age, and years worked as firefighter were not adjusted for in this comparison.

In conclusion, there was a high prevalence of respiratory symptoms as well as signs of psychological disturbances, such as extreme mood scales, irritability and sleeping problems in the surveyed population but the data show no apparent association between the health effects reported at the time of the interview and exposure to the fire. Although this may be due to the lack of an appropriate control group, the reported health problems, both physical and psychological, are more likely due to the long-term physical health effects of working as a fire fighter and undoubtedly also reflect the high degree of stress experienced by professionals in that particular occupation.

VII. RECOMMENDATIONS

1. Based on the results of this investigation there does not appear to be a need for further medical evaluation and follow-up of the specific symptoms and health effects reported in the initial request. However, periodic physical examinations, as a general practice for fire fighters and as a surveillance method to detect developing health effects, should be provided. The examinations should include pulmonary function testing, chest x-rays, and cardiovascular evaluation, including stress electrocardiograms when appropriate, in addition to hematologic and liver function screening. Such a health maintenance program should not only encompass the early detection of toxic effects of chemical and physical agents but should also facilitate the detection of signs and symptoms of ill health related to high levels of stress.

2. Counseling should be made available to all fire fighters, this should be in the form of individual sessions and group seminars and should be under the guidance of individuals who have first hand experience with the different stressors that rescue workers are exposed to. This could result in identification and modification or reduction of particular stressors as well as behavioral changes leading to increased ability to cope with high levels of stress.

3. A physical fitness program, with special regard to the reduction or modification of personal as well as job-related riskfactors should be designed and made available to emergency personnel.

4. Fire fighters and other personnel who attend fires should be appraised before hand of the types of fires and exposures that could occur in their district so that appropriate precautions may be taken.

5. Protective equipment should be available in sufficient quantities.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENT

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IX. DISTRIBUTION AND AVAILABILITY

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

Copies of this report have been sent to:

Clark County Fire Department
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NIOSH Region IX
Designated State Agencies

For the purpose of informing the employees, the employer will promptly "post" this report for a period of thirty (30) calender days in prominent places near where the employees work.

X. REFERENCES

1. EITS Manual for the Profile of Mood States: McNair DM, Lorr M, Droppleman LF, Educational and Industrial Testing Service, San Diego California.

2. Occupational Diseases, A Guide to their Recognition, U.S. Department of Health, Education and Welfare; CDC; NIOSH, June 1977, Publication Number 77-181.

3. Health Hazards of Plastics: Eckhardt, Journal of Occupational Medicine, Vol. 15, No. 10, 811-812, 1973

4. NIOSH Technical Assistance Report TA 79-50, International Association of Fire Fighters, Alliance, Ohio, September 1980

5. NIOSH Interim Report No. 3, HE 80-118, International Association of Fire Fighters, Elizabeth, New Jersey, July 1981

6. Job Decision Latitude, Job Demands, and Cardiovascular Disease: A prospective study of Swedish Men: Karasek R, Baker D, et. al., American Journal of Public Health, vol 71, nr 7, July 1981.

7. Job Demands, Job Decision Latitude, and Mental Strain; Implications for Job Redesign: Karasek R, Admin Sci Quart 1979; 24:285-308.

8. Natural Disasters and Human Behavior; Explanation, Research, and Models: Glenn C, Psychology 1979:16:2:23-36.

9. Coping Behavior after Shipwreck: Henderson A, British Journal of Psychiatry, 1977:131:15-20.

10. Emergency Decision Making; A Theoretical Analysis of Responses to Disaster Warnings: Janis I, Journal of Human Stress, 1977:3:2:35-38.

11. Coping With Internal Disaster is a Hospital Priority; Seaver D J: Hospitals, 1977: 51:14:167-172.

12. Psychic Reactions in Disasters; Knoepfel H: Schweizerische Zeitung der Militarmedizin, 1974:51:2:85-92.

13. Social Services in a War Emergency; Golan N: Social Services Revue; 1974:48:3:422-427.

14. Search and Rescue Missions in Natural Disasters and Remote Settings; Drabek T: University of Denver, Dept of Sociology, Grant No. ENV77-14162.,

TABLE 1

PREVALENCE OF PHYSICAL SYMPTOMS AND HEALTH PROBLEMS
REPORTED ON QUESTIONNAIRE

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

	PREVALENCE	
	FOR MORE THAN THREE DAYS AFTER FIRE	AT TIME OF INTERVIEW*
SHORTNESS OF BREATH	26 % (93)	10 % (36)
COUGH	42 % (150)	20 % (71)
WHEEZING	22 % (78)	7 % (25)
NOSE AND/OR THROAT IRRITATION	47 % (167)	16 % (57)
SKIN DISORDER	6 % (21)	4 % (14)
NUMBNESS OR TINGLING	6 % (21)	5 % (18)
DIZZINESS OR NAUSEA	16 % (57)	5 % (16)
OTHER HEALTH PROBLEMS	-	26 % (93)

* - TWO MONTHS AFTER FIRE

TABLE 2

PREVALENCE OF PSYCHOLOGICAL SYMPTOMS AND PROBLEMS REPORTED ON QUESTIONNAIRE AT TIME OF INTERVIEW IN TOTAL STUDY GROUP AND AMONG SMOKERS AND NON-SMOKERS

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

	PREVALENCE*		
	TOTAL GROUP	SMOKERS	NON-SMOKERS
TROUBLE FALLING ASLEEP OR STAYING ASLEEP	28 %	34 %	24 %
MORE FREQUENT USE OF SEDATIVES OR SLEEPING PILLS	5 %	7 %	4 %
LOSS OR LACK OF APPETITE	9 %	12 %	7 %
INCREASED IRRITABILITY OR NERVOUSNESS	28 %	31 %	27 %
FREQUENT HEADACHES AND/OR FEELING OF TENSION	32 %	40 %	29 %
DIFFICULTIES IN RELAXING DURING YOUR TIME OFF	26 %	36 %	21 %
SUFFERING FROM PSYCHOLOGICAL TRAUMA SUSTAINED AT MGM FIRE	8 %	12 %	6 %

* - AT TIME OF INTERVIEW, TWO MONTHS AFTER FIRE

TABLE 3

AVERAGE PROFILE OF MOODS STATES (POMS) SCORES AMONG
FIRE FIGHTERS AND MALE REFERENTS AT TIME OF INTERVIEW

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

MEAN SCORE (M) AND STANDARD DEVIATION (D)

	TENSION		DEPRESSION		ANGER		VIGOR		FATIGUE		CONFUSION	
	M	D	M	D	M	D	M	D	M	D	M	D
FIRE FIGHTERS												
TOTAL GROUP	8.6	6.5	6.3	7.9	7.0	8.4	17.1	6.1	6.0	6.3	5.3	4.5
RESPONDENTS WITH:												
THREE OR MORE PHYSICAL SYMPTOMS*	14.9	9.3	11.3	14.4	14.1	13.9	14.6	6.0	12.6	8.4	9.6	7.3
ONE OR TWO PHYSICAL SYMPTOMS*	10.4	6.0	7.4	7.5	8.3	8.2	15.6	5.9	8.2	7.0	6.2	4.4
NO PHYSICAL SYMPTOMS*	7.2	5.9	5.3	7.0	5.8	7.5	18.1	6.1	4.4	4.8	4.6	4.1
SMOKERS	9.7	7.1	7.1	8.0	8.2	9.3	15.7	6.2	7.5	7.2	5.3	4.5
NON-SMOKERS	8.0	5.9	5.7	7.2	6.2	7.5	17.8	6.0	5.2	5.5	5.1	4.4
COLLEGE STUDENTS	12.9	6.8	13.1	10.5	10.1	7.8	15.6	6.0	10.4	6.2	10.2	5.2
PSYCHIATRIC OUTPATIENTS	18.4	8.8	22.3	15.0	13.5	10.3	11.3	6.7	10.1	7.6	12.4	6.7

* - AT TIME OF THE INTERVIEW TWO MONTHS AFTER FIRE

** - STANDARD DEVIATION IS A STATISTICAL MEASURE OF THE SPREAD OF THE VARIABLE

TABLE 4

PREVALENCE OF PHYSICAL SYMPTOMS AND HEALTH PROBLEMS
AMONG SMOKERS AND NON-SMOKERS REPORTED ON QUESTIONNAIRE

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

	PREVALENCE			
	FOR MORE THAN THREE DAYS AFTER FIRE		AT TIME OF INTERVIEW*	
	SMOKERS	NON-SMOKERS	SMOKERS	NON-SMOKERS
SHORTNESS OF BREATH	37 %	19 %	18 %	5 %
COUGH	42 %	43 %	25 %	18 %
WHEEZING	26 %	20 %	12 %	5 %
NOSE AND/OR THROAT IRRITATION	48 %	47 %	19 %	15 %
SKIN DISORDER	7 %	6 %	6 %	3 %
NUMBNESS OR TINGLING	8 %	5 %	5 %	4 %
DIZZINESS OR NAUSEA	18 %	14 %	7 %	3 %
OTHER HEALTH PROBLEMS	-	-	32 %	23 %

* - TWO MONTHS AFTER FIRE

TABLE 5

PREVALENCE OF FIRE FIGHTERS WITH MULTIPLE PHYSICAL AND PSYCHOLOGICAL SYMPTOMS REPORTED ON QUESTIONNAIRE

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

	PREVALENCE*
NO PHYSICAL SYMPTOMS	62 %
ONE OR TWO PHYSICAL SYMPTOMS	32 %
THREE OR MORE PHYSICAL SYMPTOMS	6 %
NO PSYCHOLOGICAL SYMPTOMS	51 %
ONE OR TWO PSYCHOLOGICAL SYMPTOMS	26 %
THREE OR MORE PSYCHOLOGICAL SYMPTOMS	24 %

* - AT TIME OF INTERVIEW, TWO MONTHS AFTER FIRE

TABLE 6

AVERAGE PROFILE OF MOODS STATES (POMS) SCORES AMONG
FIRE FIGHTERS IN CLARK COUNTY, NEVADA, AND ALLIANCE, OHIO

CLARK COUNTY FIRE DEPARTMENT
LAS VEGAS, NEVADA

JANUARY 1981

MEAN SCORE (M) AND STANDARD DEVIATION (D)

	TENSION		DEPRESSION		ANGER		VIGOR		FATIGUE		CONFUSION	
	M	D	M	D	M	D	M	D	M	D	M	D
CLARK COUNTY FIRE FIGHTERS												
RESPONDENTS WITH:												
THREE OR MORE PHYSICAL SYMPTOMS*	14.9	9.3	11.3	14.4	14.1	13.9	14.6	6.0	12.6	8.4	9.6	7.3
ONE OR TWO PHYSICAL SYMPTOMS*	10.4	6.0	7.4	7.5	8.3	8.2	15.6	5.9	8.2	7.0	6.2	4.4
NO PHYSICAL SYMPTOMS*	7.2	5.9	5.3	7.0	5.8	7.5	18.1	6.1	4.4	4.8	4.6	4.1
ALLIANCE FIRE FIGHTERS												
EXPOSED GROUPS WITH HEALTH EFFECTS (RANGE)	13.8-15.9		9.5-14.2		7.8-16.4		13.3-16.1		10.1-13.6		9.7-10.7	
EXPOSED GROUPS WITHOUT HEALTH EFFECTS (RANGE)	7.1-14.7		5.6- 9.2		6.9-12.5		14.0-16.2		4.6-12.3		4.8- 7.2	
NON-EXPOSED GROUP	7.8		5.8		6.5		19.4		5.9		4.2	

* - AT TIME OF THE INTERVIEW TWO MONTHS AFTER FIRE

** - STANDARD DEVIATION IS A STATISTICAL MEASURE OF THE SPREAD OF THE VARIABL