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INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS (IAFF)
JERSEY CITY, NEW JERSEY

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I. SUMMARY

On April 16, 1991, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the International Association of Fire Fighters (IAFF), on behalf of fire fighters from the Jersey City Fire Department (JCFD), to assess the health and safety practices used during a response to a fire at an illegal dumpsite on April 10-12, 1991, in Jersey City, New Jersey. The IAFF reported that over 300 fire fighters and other response personnel were involved in the incident and that approximately 90 had reported chemical exposure injuries.

In response to this request, NIOSH investigators conducted a site visit to the JCFD on April 22-24, 1991. Several meetings were held with representatives from several of the responding agencies, and a tour of the fire scene was conducted. Incident reports, air sampling results, medical records, and other pertinent reports from the responding agencies were reviewed. A copy of the JCFD incident command system was also obtained for review. In addition, the U.S. Environmental Protection Agency (EPA) collected and analyzed samples of fire fighter turnout gear to address decontamination issues. The results of this analysis were provided to NIOSH for review.

The fire suppression activities during this incident were hampered by high winds and several directional wind shifts. During the incident, several fire fighters reportedly did not wear their self-contained breathing apparatus (SCBA) or depleted their supply of air cylinders. Air monitoring performed by the New Jersey Department of Environmental Protection (NJDEP) during the incident indicated that methylene chloride may have been present in the smoke plume at concentrations reaching 400 parts per million (ppm). Numerous fire fighters were treated on site by the responding emergency medical services (EMS) for dizziness, mucosal irritation, and elevated blood pressure. EMS personnel also noted abnormalities on the field cardiac monitors among several fire fighters. According to the EMS records, 171 fire fighters were transported to 8 area hospitals, and 3 were eventually admitted. However, the JCFD report stated that 68 fire fighters received incident related injuries. Representatives from the responding agencies indicated that there were several instances of coordination and communication difficulties. These difficulties led to confusion concerning incident classification (debris fire or hazardous materials incident) and command structure (single versus unified). Other problems that were encountered included the exchange of information between responding agencies, the use of SCBAs by the fire fighters, the delegation of authority to deputies in areas such

as incident safety, and the establishment of a staging area. The EPA analyzed the fire fighter turnout gear for the presence of metals, pesticides, herbicides, polychlorinated biphenyls, dioxins, and polynuclear aromatic hydrocarbons. This analysis was performed to address decontamination issues; however, the results were inconclusive.

On the basis of the information obtained during this investigation, the NIOSH investigators were unable to determine a definitive environmental cause to explain the adverse health affects experienced by numerous fire fighters during this incident, even though possible acute exposures to methylene chloride may have been a contributing factor. However, several limitations regarding the application of incident command and safety procedures were identified. Recommendations regarding these procedures are presented in Section IX of this report.

KEYWORDS: SIC 9224 (Fire Protection), fire fighters, firefighters, methylene chloride, dump fire, waste, incident command system, health effects, electrocardiogram, self-contained breathing apparatus.

II. INTRODUCTION

On April 16, 1991, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the International Association of Fire Fighters (IAFF), on behalf of fire fighters from the Jersey City Fire Department (JCFD), to assess the health and safety practices used during a response to a fire at an illegal dumpsite on April 10-12, 1991, in Jersey City, New Jersey. The IAFF reported that over 300 fire fighters and other response personnel were involved in the incident and that approximately 90 had reported chemical exposure injuries. The IAFF requested that NIOSH review the response procedures, characterize the potential exposures that may have occurred during this incident, including post-incident decontamination, and review the medical monitoring provided to all exposed fire fighters.

In response to this request, NIOSH investigators conducted a site visit to the JCFD on April 22-24, 1991. On April 22, an opening conference was held to discuss the incident and the nature of the request with representatives of the JCFD, the Jersey City Mayor's office, the IAFF (Locals 1066 and 1064), the Jersey City Medical Center (JCMC), the U.S. Environmental Protection Agency (EPA), and the State of New Jersey Department of Environmental Protection (NJDEP). During the remainder of the site visit, individual meetings were held with representatives from several of the responding agencies, and a tour of the fire scene was conducted. Incident reports, air sampling results, medical records, and other pertinent reports from the responding agencies were reviewed. A copy of the JCFD incident command system was also obtained for review. In addition, the EPA collected and analyzed samples of fire fighter turnout gear to address decontamination concerns. The results of this analysis were provided to NIOSH for review. The EPA analyzed the fire fighter turnout gear for the presence of metals, pesticides, herbicides, polychlorinated biphenyls, dioxins, and polynuclear aromatic hydrocarbons. Samples were collected from: (a) one set of turnout gear used by a fire fighter during this incident, and (b) a set of turnout gear that was not used during this incident.

This report summarizes work practices as they affected the health and safety of the fire fighters, including the incident command system, safety management, and the arrangements for medical services; discusses decontamination; and provides recommendations.

III. BACKGROUND

On April 10, 1991, the JCFD responded to a fire at the New Jersey Turnpike Dump #5 located in Jersey City, Hudson County, New Jersey. The approximately 16-acre site is comprised of three lots owned by the Municipality of Jersey City. The site contained large amounts of industrial and demolition debris and reportedly included illegally disposed waste. The debris included large quantities of tires and partially buried drums containing unknown materials. The site was not listed on the EPA's National Priorities List (NPL) but had been the subject of investigations by the EPA and the NJDEP and numerous fire responses. A brief history of the site is included in Appendix A.

At 1331 hours (military time), on April 10, 1991, the JCFD received a 911 telephone call reporting a fire at the New Jersey Turnpike #5 dumpsite. The first fire fighters arrived on the scene at 1335 hours. A second alarm was issued at 1350 hours, and seven additional alarms were issued from 1417 to 1600 hours, including recalls of off-duty fire fighters. The response to the alarms included 22 engine companies, 6 aerial apparatus units, and 9 other vehicles. The majority of the fire fighters were from the JCFD; however, fire fighters from the cities of Hoboken and New York were also involved. In addition, several federal, state, county, and local response personnel were involved with the incident. A list of the organizations that responded to the fire are included in Table I. Fire fighting efforts were hampered by 25- to 30-mile-per-hour (mph) winds with gusts up to 50 mph and several directional wind shifts. In addition, a thick, black plume of smoke emitted by burning tires migrated across the Hudson River and into Manhattan. Numerous fire fighters experienced some degree of smoke inhalation and were either treated on-site or sent to a hospital. According to the JCFD fire report, 150 personnel responded to the fire and 68 fire fighters received incident-related injuries. The fire was brought under control at approximately 1600 hours on April 10, but continued to burn until the morning of April 11. All of the responding JCFD companies had returned to their stations by 1218 hours on April 13.

IV. METHODS

The incident response and medical information was collected from several sources. This information was used to reconstruct events and procedures used during the incident response, to characterize potential exposures encountered by the fire fighters, and to review fire fighter symptoms associated with the incident. Reports of the incident chronology and fire fighter health effects were provided by JCFD and JCMC representatives during the opening conference on Monday, April 22. Additional meetings or telephone interviews were also conducted with representatives from several agencies or organizations regarding their activities during the incident. Medical interviews were conducted with representatives of the Jersey City Medical Center emergency room, the Jersey City Emergency Medical Services (EMS), attending physicians for the fire department, and community physicians who treated fire fighters after the incident. When possible, these interviews included reviews of medical records for the treated fire fighters.

To address decontamination issues, NIOSH investigators reviewed the results of turnout gear sampling performed by the EPA. On April 30, 1991, EPA personnel collected fabric samples from two sets of JCFD turnout gear. One set was used during the dump fire; the other set was used during previous fires but not during the dump fire. Two-inch by two-inch swatches were collected from the right knee, the right cuff of the pants, and the tail of the jacket from each set of turnout gear. The remainder of the gear used at the dump fire was then cleaned with a commercially available cleaning solution and additional swatches from the knee and jacket tail were collected. This was done to determine if regular decontamination procedures used after the fire on the rest of the JCFD's gear had any effect on the level of suspected contamination. All the samples were analyzed for metals, pesticides, herbicides, polychlorinated biphenyls (PCBs), and both dioxins and polynuclear aromatic hydrocarbons (PAHs) using U.S. EPA methods 7471, 8150, 8080, and 8290, respectively.

V. EVALUATION CRITERIA

Fire fighters work in varied and complex environments that increase their risk of on-the-job death and injury. Every day, fire fighters in the United States are injured in the line of duty.[1] In 1993, according to the Bureau of Labor Statistics, fire fighters incurred a relatively small number of fatalities (39), as compared to other dangerous occupations, but their rate of fatal injury on the job, 16 fatalities per 100,000 employed, was three times the national rate and was highest among the protective service occupations.[2] In addition, there were 101,500 fire fighters injured in the line of duty in 1993.[1] According to 1992 National Safety Council data, the occupational injury and illness incidence rate for fire fighters was 8.2 cases per 100 full-time employees, with 3.5 cases per 100 employees involving days away from work and deaths.[3] Fire fighters face many health hazards, including: inhalation of a wide variety of toxic combustion products; chemical exposures by direct skin and eye contact; physical hazards, including heat, cold, noise and falling objects; and exposure to carcinogenic chemicals or combustion products. In over 200 residential fires in Boston, air monitoring (which focused on a small fraction of the possible combustion products) found varying air concentrations of carbon monoxide, carbon dioxide, hydrogen cyanide, benzene, nitrogen dioxide, hydrogen chloride, and acrolein.[4,5] Other toxic components of smoke can include ammonia, acrylonitrile, halogen acids, sulphur dioxide, aldehydes, isocyanates, methylene chloride, particulates, and hydrocarbons.[6-8]

Exposures to respiratory irritants such as acrolein, hydrogen chloride, and nitrogen dioxide may lead to acute and chronic respiratory problems. Disability due to pulmonary disease has long been recognized as a potential work-related hazard for fire fighters.[9] There is increasing concern about a fire fighter's exposures to carcinogens released from the combustion of synthetic materials used in building construction.[9] This concern has been compounded by mortality and morbidity studies of fire fighters, which, although they have produced inconsistent evidence, have raised the possibility of increased risks from cardiovascular disease, respiratory disease, and cancers of the nervous, hematopoietic/lymphatic, respiratory, and gastrointestinal systems, which may be attributable to exposures to the components of smoke.[10-25] Several recent studies have suggested an increased risk of: brain cancer among Washington fire fighters; brain, prostrate, colon, and lung cancer among Los Angeles fire fighters; and digestive tract cancers.[19,21,23,26] Further studies are needed to better define these risks.

Many toxic chemical compounds may be generated and released during fires, and these can vary from fire to fire.[9] Many variables control the resulting byproducts of combustion, the most important being the composition of the burning material.[27,28] Other key factors include the temperature at which pyrolysis or combustion occurs, the concentration of oxygen present, and the efficiency of combustion.[27,28]

At the New Jersey Turnpike Dump #5 fire, the burning materials consisted primarily of tires, construction debris, and drums containing unknown materials. Transformer scraps and soil soaked with PCB-contaminated oil were also present and burning. Air sampling performed by the NJDEP during the incident indicated that methylene chloride was present within the smoke plume. Other constituents were also detected, but these were not present at comparable concentrations. The possible health effects associated with exposure to methylene chloride are discussed below.

Methylene Chloride

Methylene chloride, also known as dichloromethane, is a halogenated solvent. In industry, methylene chloride is used for degreasing, paint stripping, manufacturing photographic film, textiles, and plastics, and to extract food additives.[29] The odor of methylene chloride can be detected at levels of 150 to 500 parts per million (ppm) in air and becomes obvious by 800 ppm.[30] Like other organic solvents, methylene chloride can cause depression of the central nervous system. The central nervous system symptoms of acute intoxication from methylene chloride become more severe with exposure to increasing levels of the solvent; they can range from subtle impairment of intellectual function or coordination revealed by tests of neurologic function to obvious intoxication or death. In human research studies, volunteers exposed to 250 ppm for up to 7.5 hours showed no effects, while those exposed to 300 to 800 ppm for at least 40 minutes showed altered responses to tests of neurologic function. Subjects experienced light-headedness when inhaling 500 to 1000 ppm for 1 or 2 hours; more severe effects would result from higher exposures. Although subjects reported neurologic symptoms after repeated exposures of 75 to 100 ppm, these could not be confirmed by neurologic, psychologic, or cardiac tests.[31]

In addition to its neurologic effects as a solvent, methylene chloride may affect the heart. Some chlorinated solvents make the muscle of the heart become more sensitive to adrenaline (epinephrine), sometimes resulting in an arrhythmia, and this has been suggested as a possible effect of high exposures to methylene chloride as well.[29]

When methylene chloride is absorbed into the body (primarily by inhalation), the body's metabolic breakdown of methylene chloride creates carbon monoxide as a byproduct. In the body, carbon monoxide binds to hemoglobin, the substance in the red blood cell which normally transports oxygen and carbon dioxide, to form carboxyhemoglobin (COHb). Thus, a person exposed to methylene chloride may have an elevated level of COHb. The COHb can persist for hours after the person is removed from exposure while accumulated methylene chloride is released from fat and other tissues.[31] The occupational health literature contains conflicting opinions about the significance of COHb accumulation and cardiac sensitization resulting from methylene chloride exposure.[29] Some authors state that exposure to methylene chloride at 600 ppm may result in COHb levels as high as 12%,[32] a level which has been associated with symptoms such as headache.[33] Others feel that the risk of adverse effects from COHb in this situation is likely to be a problem only for older workers or those with pre-existing coronary heart disease; these authors consider the neurologic effects of methylene chloride to be the most likely acute adverse effects.[31]

The risk of cancer from exposure to methylene chloride has been examined in animal studies. In a 1986 study, mice exposed for 2 years to 2000 or 4000 ppm of methylene chloride showed increased incidence of tumors of the lung and liver. There were also increased occurrences of benign tumors of the mammary glands in rats. It appears, however, that the carcinogenicity of methylene chloride is related to the way the chemical is metabolized (chemically changed) in the body, and that this process in mice differs from that in man. For this reason, some researchers feel that it may not be appropriate to predict human risks of cancer from methylene chloride based upon studies of mice.[31]

The effects of long-term exposure to methylene chloride in humans have been examined in epidemiologic studies of workers who were exposed for years in industry. Some of these studies showed weak evidence that older workers had increased risk of coronary heart disease, but methylene chloride was only one of several solvents to which the workers were exposed. Other studies did not show any increased risk of heart disease.[29] Although most studies have not shown an excess of cancer, one study showed more cases of pancreatic cancer than expected in a group of workers exposed to an average of 26 ppm for 23 years during the manufacture of photographic film. When the study was continued, no additional cases were found.[31] Based on the animal and human studies, NIOSH concluded that there was enough evidence to consider methylene chloride as a potential human carcinogen and to recommend that exposures to methylene chloride be kept at the lowest concentration.[34] The American Conference of Governmental Industrial Hygienists (ACGIH) has established a Threshold Limit Value (TLV) of 50 ppm, as an 8-hour time-weighted average (TWA), for methylene chloride.[35] The ACGIH has also listed methylene chloride as a suspected human carcinogen.[35] The Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Limit (PEL) of 500 ppm as an 8-hour TWA.[36] OSHA has also established an acceptable ceiling concentration of 1,000 ppm and a maximum peak concentration of 2,000 ppm.[36]

VI. INCIDENT FINDINGS

The fire was initially reported at 1331 hours on April 10, 1991, with second alarms sounded at 1350 hours. The fire chief arrived on scene shortly after the second alarm and surveyed the area. The fire consisted of burning tires and mounds of other debris and was being spread by the gusting winds. A large, black plume of smoke evolved from the fire. At that time, fire fighting activities were directed at protecting propane tanks located towards the east and the nearby manufacturing buildings. The initial command posts were located on Jersey Avenue near the fire and then at the intersection of Grand and Jersey Avenues. The command post was later moved to an upwind location away from the smoke plume, located at the end of Aetna Street under the turnpike bridge. Several additional alarms were sounded because the fire fighting efforts were hampered by the high winds and shifts in wind direction, and an evacuation of nearby residents was ordered.

Representatives from both the NJDEP and the EPA arrived on scene at approximately 1440 hours and began to coordinate their activities with the JCFD. Upon arrival, the NJDEP recommended that the current command post be moved to an area upwind of the smoke plume and that all fire fighters wear their self-contained breathing apparatus (SCBAs). The JCFD had already ordered the use of SCBAs, but several fire fighters were observed not using them. The NJDEP then began to coordinate air monitoring activities with the EPA and the Hudson Regional Health Commission (HRHC). As of 1600 hours, there were five NJDEP and three HRHC teams performing air monitoring. The EPA technical assistance team (TAT) arrived on site at approximately 1730 hours to assist with the air monitoring. The air monitoring results indicated that methylene chloride was detected at concentrations as high as 400 ppm in the immediate vicinity of the fire. Additional air monitoring was conducted to check for acid gases, carbon monoxide, hydrogen chloride, oxides of nitrogen, and cyanides. Of these, only traces of acid gases and oxides of nitrogen were detected. All these samples were collected using colorimetric indicator tubes, which are not as accurate as other air sampling methods and subject to interferences. Air samples collected by the EPA-TAT on charcoal tubes and analyzed by gas chromatography/mass spectrometry detected benzene and toluene at concentrations up to 0.055 ppm. Trace concentrations of other hydrocarbons were also detected. Additional surface and air monitoring by the EPA from locations surrounding the fire site did not indicate the presence of any dioxins, pesticides, herbicides, or PCBs. Air samples collected by the City of New York Department of Environmental Protection from locations in New York had no detectable PAHs, chlorinated hydrocarbons, or aromatic hydrocarbons.

Emergency medical services were provided mainly by the JCMC, with the assistance of other EMS units. The JCMC has been privately operated since 1989, and EMS units are provided under a contract with Jersey City. An ambulance is routinely dispatched by request from the JCFD to all active fires. Upon receipt of the initial alarm at 1331 hours, an ambulance was dispatched to the scene of the incident and arrived near the area of Aetna and Johnston streets. About the time of the second alarm (1350 hours), the EMS supervisor, who had arrived at the site, requested additional units and the disaster bus. A treatment center was established where the bus was positioned on Aetna Street. Due to wind shifts, this treatment center was moved to a more upwind location closer to the command post. However, the disaster bus could not be moved because it was blocked by fire hoses. Several fire fighters experiencing symptoms still reported to the bus but were directed to the treatment area by EMS personnel who remained at this location. A transport area was established under the turnpike bridge between 1500 and 1530 hours. In addition, a second treatment center was established at approximately 1900 hours to care for fire fighters working the north side of the fire. This center was located near the intersection of Grand, Colden, and Varick Streets. The EMS operations were terminated at approximately 1500 hours on April 11.

Fire fighters reported symptoms of dizziness and mucosal irritation. According to reports from both EMS personnel and hospital emergency room staff, many fire fighters examined on site or in hospital emergency rooms were noted to be hypertensive, with reported diastolic blood pressures up to 110 mm Hg. The EMS representatives differentiated this observation from typical fire site presentations of exhaustion, tachycardia (unusually rapid heart rates), and normal blood pressure. Some fire fighters had field cardiac monitoring using Lead II on Lifepack 10 defibrillator/monitors. The EMS representative noted some tracings showing T-wave inversions and/or ST segment elevations. Whether this finding represented poor tracing quality frequently encountered in field settings, or actual signs of cardiac ischemia, is unclear. However, none of the fire fighters with these potentially abnormal tracings complained of chest pain, a typical symptom of individuals with cardiac ischemia.

The EMS staff also reported that many of the fire fighters who reported to their station for treatment had apparently been exposed to smoke without wearing their SCBAs. The evidence for this was the presence of soot and ash over a fire fighters' entire face, rather than only along the outlines of a respirator facial seal.

According to the EMS records, 171 fire fighters were transported to 8 area hospitals. However, the JCFD report stated that 68 fire fighters received incident-related injuries. The majority of these fire fighters (135, or 79%) were transported to Jersey City Medical Center. Only 3 fire fighters were admitted to the hospital after evaluation in the emergency room, and all had been released by the time of the NIOSH site visit. Although COHb levels were determined on fire fighters with symptoms suggestive of smoke inhalation (e.g., cough, headache), the impressions of the two emergency room physicians on duty at the time were that the fire fighters were not experiencing severe illness and responded well with oxygen therapy. Carboxyhemoglobin levels were higher in cigarette smokers and those fire fighters reporting greater exposure to smoke at this fire; however, the highest COHb level observed was 6.2%, which is not typically associated with carbon monoxide poisoning symptoms, such as headache and nausea, or known to cause abnormal electrocardiogram findings. This elevated COHb level was observed in a fire fighter who recovered after treatment with 100% oxygen on a rebreathing mask. Symptoms from carbon monoxide poisoning in acute settings typically require COHb levels greater than 15%, while ST segment and T-wave changes in electrocardiograms require levels greater than 25% COHb.

The names of six fire fighters who were reportedly the most severely affected during the fire were provided by union representatives. The NIOSH investigators contacted and interviewed the area physicians who treated these six fire fighters after the incident. As a result of these interviews, an additional fire fighter who sought post-incident medical care was also identified. Acute chemical bronchitis or pneumonitis were diagnosed in several fire fighters on the basis of pulmonary function tests and other examinations. One physician reported that his patients had typically felt well on the day of the fire, then developed symptoms over the next two to three days. The observed changes in pulmonary function tests were typically reductions in forced vital capacity, with the accompanying reading of restrictive or mixed restrictive and obstructive airway patterns. Patients were treated with bronchodilating drugs or steroids, and were either completely resolved or improving at the time of the interview.

Of interest were reports of health symptoms in some of the emergency room health care workers who had cared for the fire fighters. These workers complained of headaches, and some also reported diarrhea. Some of the emergency room staff with whom we spoke reported smelling a "chemical smell" on the fire fighters' clothing. These health care workers ascribed their symptoms, which persisted up to several days after the incident, to exposure to chemicals which were present on the fire fighters' clothing. The NIOSH investigators were told that symptoms had resolved in most employees, although four were still reporting a gastrointestinal disturbance, described as an urgent need to defecate immediately after meals, with poorly formed stools. The affected employees were not available for interview on the day NIOSH investigators visited the hospital.

The EPA collected swatches from two sets of fire fighter turnout gear and analyzed them for the presence of metals, pesticides, herbicides, PCBs, dioxins, and PAHs. Swatches collected from the turnout gear used at the incident were termed "dirty", while the swatches collected from the turnout gear used at other fires but not at this incident were termed "clean." The garment used at the incident was also cleaned with a commercially available cleaning solution, and additional swatches from the dirty knee and jacket tail were then analyzed to determine if effective decontamination was feasible.

The amounts of analytes detected on several dirty swatches was greater than the amounts detected on the clean swatches; however, the analysis also indicated that several analytes were present at higher levels on the clean swatches. The analysis detected the presence of 2,4-dichlorophenoxy acetic acid (2,4-D), 2,4,5-trichlorophenoxy acetic acid (2,4,5-T), benzene hexachloride (b-BHC), 2,3,7,8-tetrachloro dibenzo-*p*-dioxin (2,3,7,8-TCDD), and several metals, including antimony, chromium, copper, lead, nickel, and zinc. Detectable amounts of PCBs and PAHs were not found on any of the samples. The analysis of the samples that were cleaned with a commercially available solution indicated that analyte concentrations were generally lower on the cleaned gear than the dirty gear. This was most apparent for the analysis of metals on the knee sample. However, the analyte concentrations on some of the cleaned samples were greater than those observed on the dirty samples. Some of these concentration differences may be attributed to variations in analyte concentrations between swatches because it was not possible to analyze the same swatch twice to determine the pre- and post-cleaning analyte concentration.

The analysis performed by the EPA of the swatches collected from the two sets of fire fighter turnout gear indicated some interesting results; however, the results could not be used to formulate definitive conclusions concerning garment contamination. In addition, the results can not be used to infer the occurrence of any potential exposures from wearing the gear. However, the analysis of the cleaned swatches indicated that it may be possible to effectively reduce the concentrations of some of the contaminants. The results for this turnout gear analysis are provided in the EPA report located in Appendix B.

VII. DISCUSSION

A. Organizational Issues

Representatives of the responding agencies indicated that there were several instances of coordination and communication difficulties due to the lack of a site-specific emergency response plan. These difficulties created problems and confusion for the responding agencies. One problem encountered was whether or not the incident should be considered a hazardous materials (hazmat) situation. Initially, some of the responding agencies treated the incident as only a tire/debris fire while others considered it a hazmat situation. From discussions with JCMC officials, the EMS units did not know that the incident could be considered a hazmat situation until well into their response. Review of records also indicated that the JCFD hazmat vehicle was never brought to the scene of the incident. Once an incident has been declared a hazmat situation, only individuals specifically trained in hazmat procedures would be involved in the direct response where contact with the hazardous materials could occur. All other personnel would only be involved in support of the hazmat activities. In addition, the need for, and use of, decontamination procedures would also be addressed in all hazmat operations.

Since there were several responding agencies, there was also confusion concerning whether the command structure would be single or unified, a concept which is discussed below. Other problems that were encountered included the exchange of information between responding agencies, the use of SCBAs by the fire fighters, the delegation of authority in areas such as incident safety, and the establishment of a staging area. There were also concerns raised regarding the medical monitoring and care provided to the exposed fire fighters. These problems can be addressed through the Incident Command System (ICS).

1. Management of the Fire Incident

Management of fire department day-to-day activities is usually vested in a Fire Chief or other titled person who serves as the commander of the fire suppression forces and their activities, including the safety of operating fire fighters.[37]

To assist in the management (especially in the operation, coordination, and effectiveness) of wide-scale fire suppression activities, a system was developed for controlling personnel, facilities, equipment, and communications. This system is known as the ICS.[38] A further refinement of the ICS by fire service organizations addressed all types of emergency incidents and included performance criteria for the components of a system that incorporated specific safety and health objectives. This has been developed into a nationally recognized standard known as the Incident Management System (IMS).[39] The National Fire Protection Association has documented the consequences of operating without such an Incident Management System, resulting in numerous deaths and injuries of fire fighters.[39,40]

The JCFD has established an ICS based on the IMS. Review of the JCFD ICS training manual indicated that it addresses JCFD command procedures but does not adequately address the issue of interagency coordination or mutual aid command procedures. The IMS requires a plan to coordinate operations with other agencies that have jurisdiction at the incident scene. This plan includes a standard procedure to designate one incident commander or to establish unified command. The IMS states that this is best accomplished by developing an integrated system in cooperation with all of the agencies that would be expected to work together at routine or large scale incidents. It is possible that other agencies would not be willing to develop fully integrated incident management systems with the JCFD. In these circumstances, the JCFD should utilize its own capabilities to develop and implement an IMS that meets the intent of this standard. The IMS also provides another approach that may be employed where different agencies have specific jurisdiction over different aspects of an incident. The "lead agency" concept dictates that one agency would assume overall command of the incident, while other agencies fulfill their jurisdictional responsibilities under coordination of the lead agency's incident commander. If plans are not established in advance, the authority for overall command of the incident could be in doubt.

In addition, it was reported by a responding agency that briefings were not regularly conducted at the incident and that, when conducted, their representative was not allowed to attend. If true, this would indicate incomplete implementation of the IMS, which dictates that the incident commander shall determine the overall strategy for the incident and communicate this strategy to all supervisory levels of the incident management structure. The incident commander should ensure that any change in strategy is communicated to all supervisory levels. This is generally accomplished by conducting routine briefings with representatives of all the responding agencies.

2. <u>Safety Management and IMS</u>

In establishing and utilizing IMS, the first priority must be life safety.[38,41] The responsibility for this priority issue is that of the officer in command of the emergency incident.[40,41] The incident commander is responsible for the overall safety of all members and all activities occurring at the scene. The Fire Chief, however, bears the ultimate responsibility for the safety and health of all members of the Department.

The IMS encourages the delegation of authority, but not responsibility, for the safety function at an incident to a fire fighter or other competent person, who is specially trained and knowledgeable in safe emergency operations.[38,42] The failure to delegate may cause conflict between the positions of command and safety. IMS guidelines generally recommend that the command officer, who is responsible for managing the incident on the strategic level, establish and operate from a stationary command post as soon as possible after arriving on the scene.[41] In contrast, the delegated safety officer must routinely observe operations at the scene of an incident. This means he must have full authority to move around the incident scene (fire ground) to observe and control safety concerns.[41] Based on the investigation of this incident, the NIOSH investigators found that there was some confusion as to who was in authority and free to assist the fire fighters in recognizing, evaluating, or controlling fire ground hazards. As outlined in the JCFD's ICS training manual, a safety officer would have been able to ensure that all fire fighters were properly wearing their SCBAs and that there was a sufficient number of filled, spare bottles on the scene. During this incident, there were a sufficient number of spare air cylinders available with the response of the air van; however, there was no established mechanism to resupply air bottles to the fire fighters actively involved in fire suppression operations.

3. Staging Area

The IMS dictates that fire departments should develop a standard system to manage reserves of personnel and other resources at or near the scene of the incident.[41] The JCFD's ICS training manual addresses the establishment of a staging area to aid incident operations; however, it was reported that a formal staging area was never established. The apparent lack of a staging area created confusion about how many off-duty fire fighters actually responded to the recall alarms, where and when they were assigned, and how long they were involved at the scene. There was also confusion as to how many fire fighters were actually treated by the EMS units or ultimately transported to a hospital for treatment. Reported problems with the control of responding vehicular traffic could also be attributed to the lack of a staging area.

4. Medical Services

Medical services should be provided and staffed by the most highly trained emergency medical personnel on the scene. At a minimum, these should be Emergency Medical Technician-A (Basic Life Support) personnel.[41] Their responsibility is to evaluate vital signs and examine fire fighters, provide an initial assessment, treat the personnel, and determine if they should return to duty, be rehabilitated on the scene, or be transported to a medical facility. Rehabilitation treatment should consist of additional monitoring of vital signs, removing personal protective equipment, allowing rest, providing oxygen therapy, and giving forced rehydration if necessary.[41] Additionally, these evaluations should be recorded on standard forms along with the patient's identity and health complaints and should be signed, timed, and dated.[43]

The EMS units that responded to the incident encountered some difficulties in tracking the treatment of fire fighters. Attempts to tag and monitor every fire fighter did not account for some fire fighters that sought treatment but returned to fire suppression activities, as well as others that were ultimately transported to a hospital for further treatment. In addition, EMS personnel reported several difficulties in coordinating their efforts with the incident command.

B. Exposures and Health Effects

The interpretation of exposure events, such as the fire at the Jersey City site, is always difficult. Responders report signs and symptoms which span a broad range in both type and severity. It is difficult to characterize the exposures incurred by these responders because they generally occurred out-of-doors, so that the exposure in any particular place varies with wind direction and intensity. The chemicals in the smoke exposure may vary as the fire burns different areas containing different substrates, and the products of combustion also vary with the temperature of the fire. Environmental samples may not be collected by the time the first responders arrive on the scene. Even when samples are collected, it is seldom possible to collect them from every site where responders are working and incurring exposures. In addition, most of the environmental samples were collected using colorimetric indicator tube methods, which have an accuracy of ±25% and are subject to interferences. The presence of other constituents in the smoke, such as carbon monoxide, petroleum hydrocarbons, and/or other halogenated hydrocarbons, may have influenced the colorimetric tube sample results by further reducing their accuracy. The data collected do not represent every possible exposure that could have been incurred. In addition, an individual responder's exposure to a specific contaminant may have been significantly higher or lower than the sampled levels at a particular time and place.

Nonetheless, even with all these uncertainties, the environmental sampling data suggest that fire fighters in some locations may have been acutely exposed to levels of methylene chloride which have been associated with reports of neurologic symptoms. The highest reported level of methylene chloride was 350-400 ppm on the corner of Jersey Avenue and Grand Street at 6:16 p.m. It is possible that some fire fighters may have been exposed to higher levels, but it is not possible to determine either the highest peak level or the time-weighted average exposure. It is therefore possible that neurologic symptoms may have been associated with the direct effect of methylene chloride, although the retrospective nature of this investigation makes it impossible to be certain.

Some of the COHb seen in blood samples collected in the emergency rooms may have resulted from methylene chloride exposure or from exposure to carbon monoxide produced by combustion. However, given that the highest measured level of COHb was only 6.2%, it is unlikely that the reported symptoms were caused by carbon monoxide intoxication.

The ECG findings described as "T-wave inversions or ST segment elevations" are often considered to be signs suggesting that the heart is not receiving enough oxygen, particularly when seen during exercise testing or during a heart attack. Usually that occurs because there is not enough oxygen-carrying blood reaching the heart through the coronary arteries that supply blood to the heart muscle. The most common cause is that the coronary arteries have become narrowed due to atherosclerosis. A patient with this condition may be comfortable at rest, but vigorous activity will cause increased blood flow throughout the body, requiring increased work by the heart to increase the rate of blood pumping. Under these conditions the heart muscle needs more oxygen. If the need exceeds the supply, the patient may feel chest pain, called angina. During exercise or an attack of angina, ECG findings such as changes in the T-wave or ST segment may be seen, but may revert to normal when patients cease the vigorous activity. Some patients will have these abnormalities without chest pain. Still, the NIOSH investigators share the puzzlement expressed by the EMS staff that <u>none</u> of the fire fighters with observed ECG abnormalities reported chest pain. The admitting physicians and the emergency room records also did not indicate concern about heart problems. ECG changes are also seen in the normal heart with vigorous exercise. This can include inversion of the T-wave in some wire combinations, and can be seen in well-trained athletes or others without heart disease.[44,45] In summary, the reports of abnormal cardiac monitor tracings from fire fighters at the Jersey City fire are difficult to interpret due to single lead placement and demanding field conditions. In the absence of chest pain or remarkable cardiac findings in the emergency room, there is little reason to suspect exposure-related effects to the heart.

The pulmonary effects described in the most severely affected fire fighters can reasonably be attributed to smoke inhalation. The EMS reports that affected fire fighters had soot on their faces in areas normally covered by SCBA facepieces indicate that fire fighters were not always protected from smoke exposure. Although there is a case report in the literature of pulmonary effects following a brief, high exposure to methylene chloride, this was described as pulmonary edema, or fluid accumulation in the lungs, that resolved within 18 hours.[31]

The NIOSH investigators are unable to explain the reports that fire fighters responding to this incident experienced higher blood pressures than those typically observed by Jersey City emergency medical workers during previous fires. The medical literature on methylene chloride exposure that was reviewed does not specifically discuss the effects of methylene chloride exposure on blood pressure. Methylene chloride is one of the halogenated solvents capable of depressing central nervous system function. One of the effects associated with solvent-induced central nervous system depression is dilation of the blood vessels, resulting in falling blood pressure.[30] But it seems unlikely that such a marked effect on blood pressure would occur unless central nervous system depression were so severe that other obvious changes in neurologic function (altered coordination, changes in mental status, etc.) were present. In summary, methylene chloride exposure would be expected to cause lowered, rather than elevated, blood pressure; but, even so, the effect would not be expected in the exposure situation at the Jersey City fire.

The NIOSH investigators are also unable to explain the symptoms experienced by the health care workers who cared for fire fighters in the emergency room. One could hypothesize that acute exposure to some toxin emitted from the fire fighters or their clothing could have caused acute symptoms such as headache in exposed health care workers, though there was no exposure documentation by which to identify a causative agent. It is even more difficult to explain the persistent gastrointestinal complaints which were described to the investigators, as these do not correspond to any descriptions of the effects of methylene chloride, or to the other agents which were detected at markedly lower exposure levels.

VIII. CONCLUSIONS

On the basis of the information obtained during this investigation, the NIOSH investigators were unable to determine a definitive environmental exposure to explain many of the adverse health affects experienced by numerous fire fighters during this incident, even though possible acute exposures to methylene chloride may have been a contributing factor to some of them. However, several limitations regarding the application of incident command and safety procedures were identified.

IX. RECOMMENDATIONS

The following recommendations are based on the findings of this investigation, as well as previous NIOSH investigations pertaining to fire fighting activities, and are offered to help prevent fire fighter injuries.

1. The JCFD should review their current hazard communication program to ensure that emergency response pre-planning has been conducted for all sites, where such pre-planning is warranted, within their jurisdiction. These sites would include all businesses and properties where there is a presence of hazardous materials. The emergency response plans should be developed by each site's responsible party and reviewed by the JCFD. In addition, the JCFD should investigate the existence of emergency response plans for sites outside their jurisdiction where there is a probability of receiving a request for mutual aid. These efforts should be coordinated with the fire departments of neighboring communities which have mutual aid agreements with the JCFD.

2. The JCFD ICS should be reviewed and supplemented to take into account complex fire scenes where there are multiple fire companies and equipment, mutual aid responses, and/or multi-jurisdictional elements. This should include a plan to coordinate operations with mutual aid responders and other agencies that have jurisdiction at the incident scene and procedures for creating an appropriate command structure (single, unified, or "lead agency" command). Standard operation procedures should be developed which define the roles and responsibilities for members assigned to the command staff once the appropriate command structure has been established. This should include procedures to delegate a safety officer, create and manage the staging area, and coordinate EMS activities.

3. The positions of command and safety should be separated at complex fire scenes where there are multiple fire companies and equipment, mutual responses, multiple exposures from a fire ground covering a large area, and so forth. Such separation will allow the Safety Officer to function in a manner consistent with the duties recognized as appropriate and as established by departmental standard operating procedures. The Safety Officer would be responsible for ensuring the proper use of protective equipment, including SCBAs, by fire fighters involved in all fire suppression activities.

4. Fire fighters operating at emergency incidents must always operate in teams of two or more (buddy system). A buddy system allows two fire fighters to observe each other for signs of medical emergencies and to provide assistance to each other if needed. All fire fighter team members operating in hazardous areas must be in communication with each other and with incident command through visual, audible, physical, electronic, or other means in order to provide assistance in case of emergency.

5. To aid in the overall management of the fire scene, and to assist the fire ground commander and fire fighter teams in recognition and control, personal markings to ensure positive identification of individuals, such as fluorescent and reflective name tags, letters, or other markings should be affixed to protective coats, helmets, or equipment.

6. Standard operating procedures should be established for the response of the air van. These procedures should include active mechanisms to ensure that air cylinders are supplied to fire fighters involved in all fire suppression activities, including those in which the fire ground encompasses large areas.

7. Procedures concerning on-site rehabilitation of fire fighters should be included in the department's standard operation procedures. These procedures should include guidelines for initiating and enforcing rehabilitation efforts and managing the resources and personnel within the rehabilitation sector. The responsibility for initiating the appropriate rehabilitation efforts should belong to the incident commander. These efforts should take into account the incident size, level of physical exertion, and environmental conditions. The rehabilitation sector should be located in an area outside the operational activity area, where protective equipment and clothing can be safely removed and resources appropriate to the incident can be employed.

8. Although definitive conclusions could not be derived from the analysis of the turnout gear, the results seemed to indicate that further investigation into appropriate cleaning of fire fighter turnout gear, especially after incidents of this type, may be warranted.

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Copies of this report have been sent to:

1. International Association of Fire Fighters
   Department of Occupational Health and Safety
2. IAFF, Locals 1064 and 1066
3. City of Jersey City Fire Department
4. City of Jersey City
5. Jersey City Medical Center
6. U.S. Environmental Protection Agency, Region II
7. New Jersey Department of Environmental Protection
8. OSHA, Region II

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

Organizations Responding to the Fire at the New Jersey Turnpike #5 Dumpsite
Jersey City, New Jersey
HETA 91-0190
April 10-12, 1991

Bell and Siren Club
Hoboken Fire Department
Hudson County Office of Emergency Management
Hudson County Police Department
Hudson Regional Health Commission
Jersey City Health Department
Jersey City Engineering Department
Jersey City Office of Emergency Management
Jersey City Mayor
Jersey City Fire Department
Jersey City Medical Center - Emergency Medical Services
New Jersey Department of Environmental Protection - Emergency Response Program
New Jersey Turnpike Authority
New Jersey State Police - Office of Emergency Management
New Jersey Division of Criminal Justice.
New York City Fire Department
New York City Mayor's Office
New York City Department of Environmental Protection
New York City Department of Health
New York City Emergency Medical Services
North Bergen Fire Department
O.H. Materials (EPA Technical Assistance Team)
U.S. Coast Guard
U.S. Environmental Protection Agency
University of Medicine and Dentistry - Emergency Medical Services, Mass Casualty Unit

Appendix A

Brief History of the New Jersey Turnpike #5 Dumpsite

The New Jersey Turnpike Dump #5 is located in Jersey City, Hudson County, New Jersey, in an urban residential/light industrial area adjacent to the New Jersey Turnpike. The 16 acre site is comprised of three lots (Block 60, Lots 19H, 19Q, and 19R) owned by the Municipality of Jersey City.

Block 60, Lot 19H

In 1930, Lot 19H was purchased from Central Valley Railroad by Lehigh Valley Railroad. The Municipality of Jersey City purchased the lot in 1941 and leased the property to the Greenwich Corporation, a cooperage supplies business, in 1955. The Greenwich Corporation operated on the property until a 1984 fire destroyed several buildings. However, due to various legal reasons, the corporation's lease remained in effect until 1987.

Block 60, Lots 19Q and 19R

In 1984, Lots 19Q and 19R were purchased by Jersey City from Central Jersey Industries, formerly Central Railroad of New Jersey, which owned the property since 1894. This site was vacant but had been reported to contain hazardous wastes by the Hudson Regional Health Commission in 1981.

Specific Events Related the New Jersey Turnpike Dump #5

In July 1982, when Jersey City was planning to purchase Lots 19Q and 19R as part of a proposed development project, an engineering firm was contracted by the city to perform a site analysis and determine the environmental condition of the site. During July and August, soil and water samples were collected and analyzed according to EPA guidelines. In a September 1982 report, the engineering firm stated that it was obvious that a variety of materials had been dumped on the surface of the property and that there was evidence of the disposal of liquid or powdered wastes in the form of a purple dye and from metal drums. However, the firm concluded that there was no environmental reason why the purchase of the property could not be completed by the city, since the concentration of the detected pollutants were of little environmental concern.

In February 1983, the NUS Corporation performed an inspection of the site for the EPA. The investigators found evidence of oily and powdered waste, reviewed the report from the previous investigation, and concluded that the site had a medium priority for further action. Since the site was scheduled for cleanup in the spring of 1983 by Jersey City in preparation for commercial development, a follow-up analysis was recommended after cleanup of the site was completed. However, this cleanup was never initiated.

In April 1986, the Hudson Regional Health Commission reported that a large number of drums and transformer scraps were present at the site. A soil sample was collected from an area that was "grossly oil soaked" in June 1986. The results of this sample indicated that the site was potentially contaminated with PCBs because 1380 parts per million of Aroclor 1254 was detected.

In May 1987, NJDEP notified Jersey City and the Greenwich Corporation that the site poses a danger to the public health and environment and issued a directive to have the site properly remediated.

On January 30, 1989, the NJDEP referred the clean-up of the site to the EPA. A removal site evaluation and a preliminary assessment were conducted in the spring of 1989. The EPA recommended that CERCLA/SARA funds be authorized to perform a removal action at the site.

Appendix B

Results of Turnout Gear Analysis Performed by the EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL RESPONSE BRANCH
Edison, New Jersey 08837

August 19, 1991

MEMORANDUM

SUBJECT: Jersey City Dump Final Analytical Data

FROM: Sella M. Burchette, Environmental Scientist SMB
Safety & Air Surveillance Section
Environmental Response Branch

TO: Dwayne Harrington, OSC
EPA Region II

Attached please find the final analytical data generated for the analysis performed on the turnout gear worn by firefighters involved in the response to the Jersey City Dump fire.

The report from Michael Morganti, Weston REAC (Response Engineering Analytical Contract) to me discusses the site background and subsequent methodologies utilized for analysis of the selected fabrics.

Tables 1-3 summarize the levels metals, combination pesticides/herbicides, and dioxin analysis conducted on patches from the knee, pant cuff, and jacket of both potentially contaminated and non-Jersey City Dump fire exposed turnout gear. Still, bear in mind that the columns labeled clean is gear which has been exposed to other fires but was not involved at Jersey City.

Refer to the column labeled Contamination Difference for the value differences between the "exposed" and "non-exposed" garments. In general, the "non-exposed" suits were found to have less levels contaminants. I will call attention to the metals data for jackets samples. The Difference column indicates that the clean suit was found to exhibit higher levels of contaminant than the exposed suit. Careful evaluation of all supporting data offered no additional insight as to the nature of the resulting analysis and no theory of explanation. It is noteworthy, however, to observe that the levels of all contaminants are in the µg (microgram) range.

The column labeled MSA Cleaned attempts to show whether the contaminants could effectively be removed by decontaminating the turnout gear.

Table 4 is included as a reference section for toxicity for the various compounds with respect to inhalation and dermal contact.

All tables reflect only compounds identified as "hits" in the analytical parameters, not total run listing indicating nondetects. Additional analysis was conducted for PAHs (Polyaromatic Hydrocarbons) resulting in all nondetects.

Should you require any additional assistance in this matter, please contact me at FTS 340-6726.

Attachment

cc: R. Turpin, ERT
jcfile

JERSEY CITY DUMP FIRE

JERSEY CITY, HUDSON COUNTY, NEW JERSEY

August 5, 1991

EPA Work Assignment No.: 2-497
Weston Work Order No.: 3347-21-01-3497
EPA Contract No.: 68-03-3482

FINAL REPORT

Prepared by:

Roy F. Weston Inc.

Michael Morganti
Michael Morganti 8/5/91 **Date**
Task Leader

W. Scott Butterfield
W. Scott Butterfield 8/5/91 **Date**
Project Manager

Prepared for:

U.S. EPA/ERT

Sella Burchette
Work Assignment Manager

kmd\MORGANTI\FR-3497

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

1.1 Site Background

On April 10, 1991, a fire erupted at the Jersey City Dump site located in Jersey City, Hudson County, New Jersey. The landfill was used for municipal solid waste, but it has been a suspected depository of liquid and drummed industrial waste. The Jersey City Fire Department (JCFD) responded to extinguish the fire. On arrival, the fire was out of control and consumed one unoccupied structure. Several firefighters suffered smoke inhalation; the suspected cause was JCFD's attempt to battle the fire without the use of self contained breathing apparatus (SCBA). Upon transport of the firefighters to care facilities, several firefighters, emergency medical technicians, nurses and doctors had acute cases of hypertension, soar throats, nausea and headaches. During the fire, United States Environmental Protection Agency (U.S. EPA) Region II Technical Assistance Team (TAT) took two carbon tube samples in the smoke plume and wipe samples from a building downwind. The carbon tube samples were taken to determine volatile organic compound contamination, and the wipe samples were collected to determine if there was dioxin contamination of the buildings. A post fire site walk-through conducted by the On-Scene Coordinator revealed the presence of drums of unknown origin. Furthermore, because the drums were discovered on the site and acute cases of hypertension were reported, additional potential exposure data was desired. Therefore, the fire department requested that the turn-out gear be analyzed as an indicator of exposure.

1.2 Study Objectives

The primary focus of this investigation was to quantitatively identify the contaminants found in a turn-out suit worn to the Jersey City Dump Fire and compare the suit to a typical in-service suit not worn to the fire. Response, Engineering, Analytical Contract (REAC) provided logistical and analytical support for the analysis of clothing swatches obtained from turn-out gear worn by the firefighters. REAC provided analytical support for air samples collected during the incident by Region II TAT. The analytical results for the air samples may be found in the Interim Analytical Report. However, the results will not be discussed further in this report since analysis of the samples was only requested.

2.0 METHODOLOGY

The sampling objective was to sample areas on the gear that had the highest potential for contamination. These areas were designated by the Work Assignment Manager. The rationale on which the locations were selected was based on the physical position of the firefighters during the fire. Since the fire was primarily a ground fire and not structure related, the firefighters kneeled using both knees. The three areas selected were the knee pads, cuffs of the pants and the tail of the jacket.

On April 30, 1991, U.S. EPA Environmental Response Team (ERT) and Response Engineering Analytical Contract (REAC) personnel sampled the suits stored at the Jersey City Fire Training Center in Jersey City. The suits were stored in black plastic garbage bags. Each sample was cut from the suits using a dedicated razor or scissor. Samples were first collected from the clean jacket that had been used at previous fires but not at the Jersey City Dump Fire. Six 2" x 2" swatches were collected from the right knee, right cuff of the pants and the tail of the jacket. Additional swatch samples were taken from each location on the clean suit to be used as blank samples. Blank swatches were taken from each matrix of the jacket. The outer lining of the jacket consisted of black nomex cloth, knee pads were made of black nomex cloth with leather pads sown to the outside, and the inner lining of the suits were made of flannel lined with fiber insulation. The clean suit samples were collected to approximate the previous contamination of the gear from prior fires. The same procedures were repeated for the contaminated suit except that the blank samples were not collected.

The remainder of the dirty suit was cleaned with Mine Safety Appliance Sanitizer. Ten samples were then collected in the same manner as the first set. This was to determine if regular decontamination procedures used after the fire on the rest of the department's gear had any effect on the level of suspected contamination. All samples were jarred or bagged and labeled accordingly (see Appendix A Trip Report).

3.0 RESULTS

All results are reported in micrograms per sample. The results are reported in this manner in order to compare the amount of skin contact, and not as a concentration for each sample. The weight of each sample varied which affected the detection limits for each sample and analysis. The results can be referenced in the analytical report in Appendix B.

Table 1 contains the results from the priority pollutant metal analysis in summary format. The samples were analyzed using U.S. EPA method 7471 as given by "Test Method for Evaluating Solid Waste, Sept. 1986", U.S. EPA SW-846.

Table 2 contains the results from the herbicide and polychlorinated biphenyls (PCB) - pesticide analysis in summary format. The samples were analyzed using U.S. EPA methods 8150 and 8080, respectively. PCBs were not detected in any of the samples and were excluded from the summary table.

Table 3 contains the results from the dioxin analysis in summary format. The samples were analyzed using U.S. EPA method 8290.

Table 4 contains toxicological values to be used as a reference source by the reader to compare values found in the summary tables and the analytical report to scientifically supported and established health and safety values.

The polynuclear aromatic hydrocarbons (PAH) analysis was not summarized in a table due to the changing dilution factor which changed the detection limit for each sample and contaminant. The samples were analyzed using U.S. EPA method 8290.

4.0 DISCUSSION OF RESULTS

Results are presented in tabular format without interpretation as per the instructions of the Work Assignment Manager.

TABLE 1

METAL ANALYSIS
JERSEY CITY DUMP FIRE
JERSEY CITY, HUDSON COUNTY NEW JERSEY
JUNE 30, 1991

Sample ID #	D09121	B09532	Contamination Difference	B09534	D09524	B09533	Contamination Difference	D09122	B09539	Contamination Difference	B09531	B09513	B09530	Contamination Difference
Location	Clean Knee	Dirty Knee		MSA Cleaned Knee	Clean Cuff Liner	Dirty Cuff Liner		Clean Jacket	Dirty Jacket		MSA Cleaned Jacket	Clean Jacket Liner	Dirty Jacket Liner	
Parameter	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample
Antimony	14	160	146	90	780	32	(748)	6	3	(3)	6	1400	13	(1387)
Arsenic	3	8	5	4	1	13	12	2	0.5U	(1.75)[2]	ND	4	1	(3)
Cadmium	39	86	47	31	3	43	40	9	7	(2)	12	34	14	(20)
Chromium	51000	130000	79000	84000	30	320	290	32	51	19	32	38	72	34
Copper	100	910	810	440	14	390	376	42	32	(10)	36	160	57	(103)
Lead	740	2200	1460	1100	72	2000	1928	110	80	(30)	91	200	150	(50)
Mercury	0.65	0.72	.07	ND	0.29	0.76	0.47	0.13	0.14	0.01	0.11	0.13	0.12	(0.01)
Nickel	21	67	46	37	5U	63	60.5[1]	5	5U	(2.5)[2]	ND	27	9	(18)
Silver	2.5U	4	2.75[1]	3	2.5U	3	1.75[1]	2.5U	2.5U	0	ND	2.5U	2.5U	0
Zinc	1300	5400	4300	2900	220	11000	10780	150	170	20	150	340	340	0
Amount of sample used for PP metals (grams)*	2.96	7.05		7.70	0.93	4.04		0.47	0.57		1.22	1.30	1.19	
Amount of sample used for Mercury (grams)*	0.65	2.31		2.52	0.29	1.16		0.26	0.21		0.42	0.43	0.42	

U denotes detection limit

* Sample size changes the detection limit for each sample.

1 Half of the detection limit for the clean result was subtracted from the dirty result.

2 Half of the detection limit for the dirty result was used for the subtraction of the clean result.

( ) Values for the dirty result were less than the clean result.

TABLE 2
HERBICIDE AND PESTICIDE ANALYSIS
JERSEY CITY DUMP FIRE
JERSEY CITY, HUDSON COUNTY NEW JERSEY
JUNE 20, 1991

Herbicides														
Sample ID #	C 09526	C 09532	Contamination Difference	C 09534	D 09528	C 09533	Contamination Difference	B 09522	C 09529	Contamination Difference	C 09531	B 09523	C 09530	Contamination Difference
Location	Clean Knee	Dirty Knee		MSA Cleaned Knee	Clean Cuff Liner	Dirty Cuff Liner		Clean Jacket	Dirty Jacket		MSA Cleaned Jacket	Clean Jacket Liner	Dirty Jacket Liner	
2,4-D (ug/sample)	0.31	1.06	0.75	0.46	0.40	0.35	(0.05)	0.74	1.65	0.91	1.06	0.22	0.13	(0.09)
2,4,5-TP (ug/sample)	0.2U	0.54	0.44[1]	ND	ND	ND	0	ND	ND	0	ND	ND	ND	0
2,4,5-T (ug/sample)	0.21	0.2U	(0.11)[2]	ND	ND	ND	0	0.2U	1.06	(0.9)[1]	0.67	ND	ND	0
Pesticides														
Sample ID #	A 09516	B 09512		B 09534	A 09528	B 09533		D 09522	B 09529		B 09531	D 09523	B 09530	
Location	Clean Knee	Dirty Knee		MSA Cleaned Knee	Clean Cuff Liner	Dirty Cuff Liner		Clean Jacket	Dirty Jacket		MSA Cleaned Jacket	Clean Jacket Liner	Dirty Jacket Liner	
b-BHC (ug/sample)	1.00U	1.80J	1.30[1]	4.40J	0.5J	0.65J	0.15	1.00U	0.20J	(0.3)[1]	0.40J	1.00U	0.40J	(0.10)[1]

U denotes detection limit

J denotes below detection, estimated concentration.

[1] Half of the detection limit for the clean result was subtracted from the dirty result.

[2] Half of the detection limit for the clean result was subtracted from the clean result.

( ) Values for the dirty result were less than the clean result.

TABLE 3

DIOXIN ANALYSIS
JERSEY CITY DUMP FIRE
JERSEY CITY, HUDSON COUNTY NEW JERSEY
JUNE 30, 1991

Sample ID#	Method Blank	Method Blank	A 09521	A 09532	Contamination Difference	A 09534	A 09522	A 09529	Contamination Difference	A 09531	A 09523	A 09530	Contamination Difference	A 09524	A 09533	Contamination Difference
Location	N/A	N/A	Clean Knee	Dirty Knee		MSA Cleaned Knee	Clean Jacket	Dirty Jacket		MSA Cleaned Jacket	Clean Jacket Liner	Dirty Jacket Liner		Clean Knee Liner	Dirty Knee Liner	
Date of Analysis	05/07/91	05/08/91	05/07/91	05/07/91		05/08/91	05/08/91	05/07/91		05/07/91	05/08/91	05/07/91		05/07/91	05/08/91	
2,3,7,8-TCDD (ng)	ND	ND	0.01U	0.05	0.045[1]	0.07	ND	ND	0	ND	0.01U	0.01	0.005	0.01U	0.02	0.015[1]

ND Not Detected.

[1] Half of the detection limit for the clean result was subtracted from the dirty result.

U Denotes detection limit.

TABLE 4

REFERENCE VALUES
JERSEY CITY DUMP FIRE
JERSEY CITY, HUDSON COUNTY NEW JERSEY
JUNE 30, 1991

Compound	ACGIH (TLV/TWA) (mg/m^3) *		Inhalation Toxicity **	Skin Toxicity **
Antimony	0.5		N/A	N/A
Arsenic	0.2		N/A	N/A
Cadmium	Salts - 0.05 Fume - 0.05 Production - 0.05	Proposed changes Total Dust - 0.01 Respirable Fraction - 0.002	TCLo - 88 ug/m^3 /8.6 Years TCLo - 39 mg/m^3 /20 Minutes	N/A
Chromium	0.5		N/A	N/A
Copper	Fume - 0.2 Dust/mist - 1.0		N/A	N/A
Lead	0.15		TCLo - 10 ug/m^3	N/A
Mercury	Alkyl compounds- 0.01 All forms except alkyl vapor - 0.05 Aryl & Inorganic compounds - 0.1		Man - TDLo - 44300 ug/m^3 /8 Hours Women - TCLo - 150 ug/m^3 /46 Days	129 mg/m^3 /5 Years
Nickel	1.0	Proposed change - 0.05	N/A	N/A
Silver	0.1		1 mg/m^3	N/A
Zinc	Oxide/Fume - 5.0 Dust - 10.0		TCLo - 600 mg/m^3 TCLo - 124 mg/m^3 /50 Minutes	N/A
(2,4-Dichlorophenoxy)acetic acid	10.0		N/A	Moderately Toxic by skin contact.
2-(2,4,5-Trichlorophenoxy)propionic acid (Silvex)	N/A		N/A	N/A
(2,4,5-Trichlorophenoxy)acetic acid	10.0		[1] Readily absorbed by inhalation.	Slowly absorbed through skin.
b-BHC (Benzene Hexachloride)	N/A		Poison by Inhalation	N/A
2,3,7,8-TCDD	N/A		N/A	TCLo - 107 ug/m^3

TDLo - Toxic Dose Low - the lowest dose of material introduced by any route, other than inhalation, over any given period of time and reported to produce any toxic effect in humans or to produce carcinogenic, neoplastigenic, or teratogenic effects in animals or humans.

TCLo - Toxic Concentration Low - the lowest concentration of a material in air to which humans or animals have been exposed for any given period of time that has produced any toxic effect in humans or to produce carcinogenic, neoplastigenic, or teratogenic effect in animals or humans.

1 - Unspecified route of exposure.

* - 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. American Conference of Governmental Industrial Hygienists. 1990

** Ref.- Dangerous Properties of Industrial Material: 7th Edition. N. Irving Sax and Richard J. Lewis, Sr. 1989.

N/A - No data available.

REAC PROJECT
GSA RARITAN DEPOT
2890 WOODBRIDGE AVENUE
BLDG 209 ANNEX
EDISON, NJ 08837-3679

TO: Sella Burchette, EPA Work Assignment Manager

FROM: Michael Morganti, REAC Task Leader

THRU: Gary Buchanan, REAC Section Chief

SUBJECT: CLOTHING SAMPLING AT JERSEY CITY DUMP FIRE
Work Assignment # 2-497 - TRIP REPORT

DATE: May 21, 1991

BACKGROUND

On April 10, 1991 a fire of suspicious origin was reported at the Jersey City Municipal Landfill site. Initial unsubstantiated verbal reports from the Jersey City Fire Department stated that there was a possibility of the fire spreading to or involving drummed materials adjacent to the landfill. On Thursday April 10, 1991 the EPA Region II Technical Assistance Team (TAT) arrived on-site. The TAT team collected two carbon tubes and numerous wipe samples from a building within the plume to analyze for dioxin, specifically for 2,3,7,8 - TCDD. The fire was brought under control and extinguished on April 12, 1991. Shortly after the incident, several firefighting, emergency medical and nursing personnel exhibited signs of mild hypertension, sore throats, rashes, and nausea. At this time the U.S. Environmental Protection Agency, Environmental Response Team (EPA/ERT) was requested to analyze the firefighters turn-out gear for dioxins, herbicides, polychlorinated biphenyls (PCBs)/pesticides, metals, and polyaromatic hydrocarbons (PAH).

OBSERVATIONS AND ACTIVITIES

On Tuesday April 30, 1991 at 1300 hours, the project team, consisting of Michael Morganti, REAC Task Leader; Rod Turpin, EPA/ERT; Michael Solecki, EPA/ERT; and Dwane Harrington, On-Scene Coordinator (OSC) departed the GSA Facility for the site. At 1332 hours the project team arrived at the site located near the New Jersey Turnpike just before exit 14B. Photodocumentation was collected at this time. At 1344 hours, the project team arrived at the Jersey City Fire Department Headquarters to meet with George Geyer, union representative for the Jersey City Firefighters. The meeting provided information about the health problems associated with the site, sore throats, nausea, rashes, headaches and mild hypertension were the symptoms described to the team. George Geyer submitted specifications on the types of coats used by the department as well as vendor information on where to purchase replacement suits. At 1448 hours, sampling commenced at the Jersey City Fire Training Center where the suits had been stored in black plastic bags immediately following the fire. The team was supplied with two sets of turn-out gear, both worn at previous fires, to analyze for chemical contamination. The second suit was also worn at the Jersey City Dump Fire. Responsibilities were divided among team members: Michael Morganti, sample management, Rod Turpin and Michael Solecki, sample collectors.

The Work Assignment Manager, prior to field activities, designated two areas on the suits from which the samples were taken. Using a dedicated scissor or razor knife swatches measuring 6" x 6" were cut from the knee, the tail of the jacket, the liner of the jacket and the liner of the cuff. Once the swatches were cut out, they were divided into six 2" x 2" squares. Five out of six of these squares were used for analysis. The blanks were obtained in the same manner. Each square was individually bottled and marked for a single analysis. The remaining square was discarded. The same procedure was employed for the dirty suit except for the addition of two extra outer suit swatches which were washed with MSA cleaner, bottled and labeled with appropriate field data sheet documentation. MSA cleaner is a cleaning sanitizer produced by Mine Safety Appliances company to decontaminate rubber based products. The liners of the jacket and pants were not cleaned with this cleaner because the matrix is not rubber. The suits were cleaned to determine if the suits would be salvageable in case of contamination. Forty bulk samples were collected from the suit not worn at the Jersey City Dump Fire site. Twenty of these samples were for analysis to establish a baseline and twenty were used as blanks. Thirty samples were collected from the suit worn at the Jersey City Dump Fire. Twenty samples were used for direct analysis, ten were washed and then analyzed. The remaining portions of the suit were bagged and stored at the training academy pending sample analysis. At 1630 hours sampling and the chain of custodies were completed, and samples packed. At 1750 hours ERT/REAC arrived at the GSA facility. The samples were segregated and signed over to John Lintott, REAC Sample Receiving.

Future Activities

The following activities are anticipated:

- Arrangement of subcontracted analysis. May 1, 1991
- Issuance of the preliminary results for dioxin. May 10, 1991
- Issuance of the Final Analytical Report. June 17, 1991
- Issuance of the Final Report. July 30, 1991
- No future field activities are planned at this time.

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