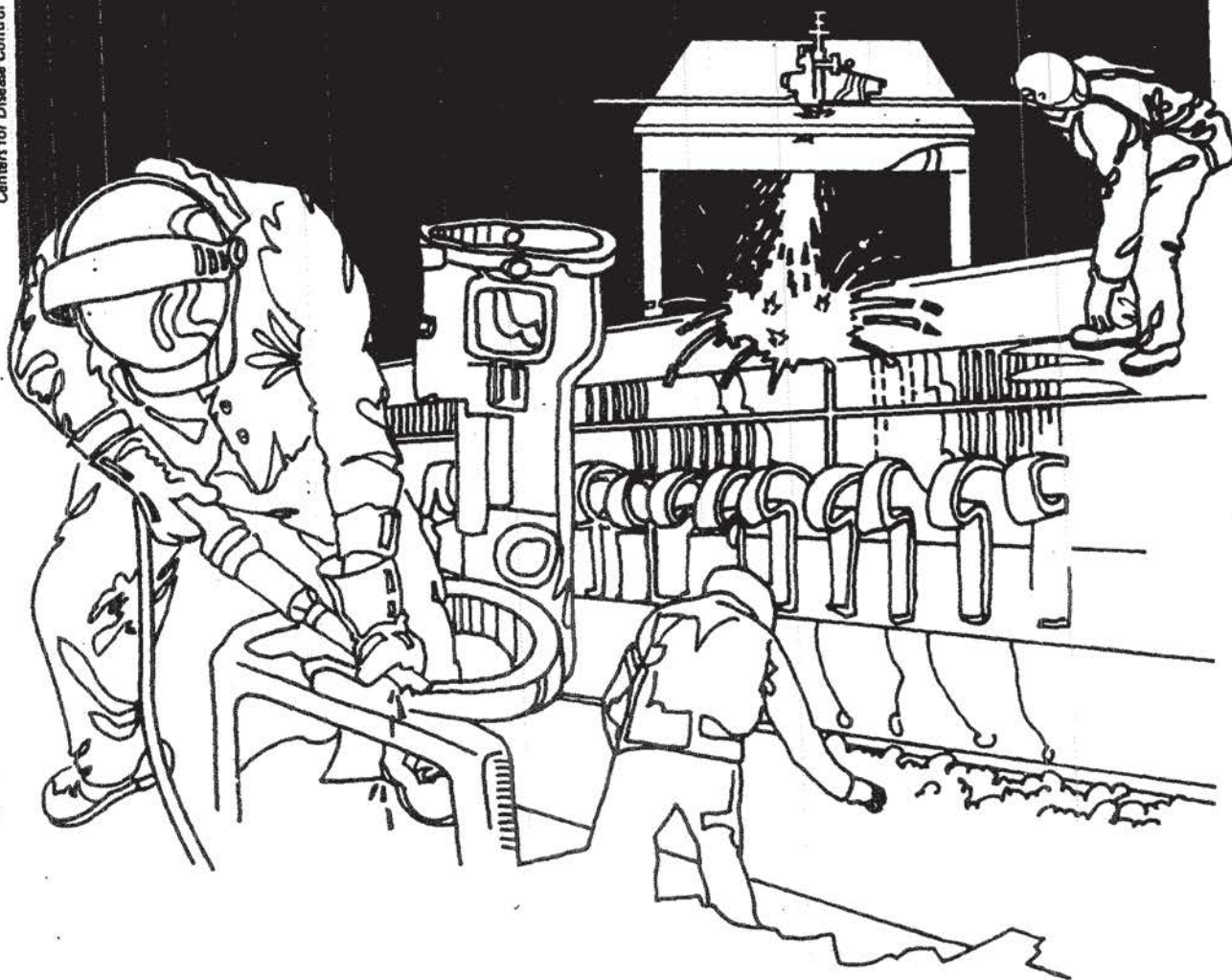


NIOSH



Health Hazard Evaluation Report

HETA 83-326-1535
LIQUID DISPOSAL INCORPORATED
SHELBY TOWNSHIP, MICHIGAN

PREFACE

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

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

HETA- 83-326-1535
NOVEMBER 1984
LIQUID DISPOSAL INCORPORATED
SHELBY TOWNSHIP, MICHIGAN

NIOSH INVESTIGATOR:
Kern E. Anderson

I. Summary

On June 20, 1983 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate possible health effects among firefighters following a fire that occurred on June 15, 1983 at Liquid Disposal Incorporated (LDI), a storage site for waste oils, volatile and semivolatile wastes, located in a Detroit suburb. The request also asked NIOSH to advise fire officials on decontamination procedures for personal protective gear, clothing and equipment that may have been exposed to toxic chemicals during the fire.

On July 12-13, 1983 NIOSH surveyed firefighters and police officers involved with the fire using self-administered medical questionnaires. Additionally, the Environmental Protection Agency (EPA) collected environmental samples following the fire that were analyzed for dibenzo-p-dioxins and dibenzofurans. These samples included the water used to decontaminate various firefighter gear and equipment, a composite sample of the waste oil lagoon, samples from two fly ash piles, samples of soil collected a few miles from the site, and background water and soil samples as controls.

Generally, firefighters and other personnel involved with the fire experienced only minor health effects associated with smoke and fumes. One firefighter was treated for smoke inhalation. There were no other major health problems, and none of the firefighters were hospitalized.

Of all the EPA samples, the compound of most concern was 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). TCDD was not detected in any of the samples submitted for analysis.

Although the rinse water used to wash some firefighter gear and equipment was analyzed and found totally negative for TCDD, the cost of analyzing all the clothing, gear and equipment far outweighed the cost of replacing the items. Thus, EPA authorized complete replacement of personal protective clothing, gear and equipment used at the fire.

On the basis of the data obtained during this investigation, it was concluded that there were no apparent serious health effects resulting from exposures to chemicals at the fire. It was further concluded that based upon the technology available, decontaminating the firefighters' clothing, gear and equipment was impractical and too costly. We agree with EPA's decision to replace the clothing, gear and equipment. Recommendations pertaining to on-going medical surveillance, care of work uniforms and fire fighting equipment, and an education program about toxic chemicals are presented in Section VII of this report.

KEYWORDS: SIC 9224 fire fighters, chemical fires, hazardous waste storage sites, chemical decontamination

II. Introduction

On June 15, 1983, police and firefighters from three communities responded to a fire at Liquid Disposal Incorporated (LDI) - a hazardous waste storage site located in Shelby Township, Michigan - a suburb of Detroit. LDI was under the jurisdiction of the U.S. Environmental Protection Agency's (EPA) SUPERFUND at the time of the fire.

On June 20, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Association of Firefighters (IAFF) to evaluate possible health effects among firefighters who were at the LDI fire and to advise fire officials on procedures for cleaning personal protective gear, clothing and other firefighting equipment which may have become contaminated by chemical wastes during the fire.

On June 23, 1983, a NIOSH investigator met with fire and township officials from Shelby Township, along with representatives from Local 1338 of the IAFF and several firefighters who were at the scene of the fire. Preliminary information was obtained about the fire and the gear clothing and other firefighting equipment in question were examined. (The items had been placed in plastic trash bags and delivered to one of the fire department sub-stations near LDI where they were being stored, waiting for final disposition by EPA.) The NIOSH investigator also visited the LDI dump site and met with EPA's On-Scene-Coordinator (OSC) to obtain a list of chemicals known to be contained in the site and to discuss alternatives for dealing with the firefighters' gear clothing and equipment.

On July 12-13, 1983, NIOSH surveyed the firefighters and police officers involved with the fire, using self-administered questionnaires. The questionnaires solicited information to characterize exposures and subsequent symptoms experienced by individuals at the scene, as well as other pertinent epidemiologic data.

III. Background

A. The Dump Site

Liquid Disposal Incorporated began operating as a commercial incinerator for waste oils, volatile and semi-volatile wastes in 1968. The site is located on 6.8 acres of land in an area that has an automobile junkyard adjacent to the site, a mountainous trash dump a short distance away and a major landfill site nearby as well. The northern boundary of LDI is adjacent to the Rochester-Utica State Game and Recreation Area with the Clinton River one quarter mile away. Approximately 1,000 people living within one mile of LDI, are served by well water, with the closest well located within one quarter mile of the site. The now abandoned site formerly consisted of: two lagoons (a deep waste oil lagoon with a thick sludge bed and a relatively shallow settling pond called a "scrubber" lagoon) a staged drum storage area (where

approximately 1,000 waste filled drums were stacked), a centrally located incinerator and pit containing runoff water from the entire site and twelve large volume (17,300-50,000 gallons) storage tanks, eight of which are underground.

During its years of operation, LDI had numerous problems. Frequent seepage from the lagoons operating overcapacity threatened groundwater. Compromised structural integrity of the dike system presented constant threats of mass releases of wastes into the Clinton River, had the system failed. Constant complaints from nearby residents about obnoxious odors resulted in many violations of air quality standards and the site has had three major fires. Since 1982, major problems at LDI required three emergency actions by EPA and forced the closing of the site by the Michigan Department of Natural Resources (MDNR). The first incident occurred on January 13, 1982 when a release of hydrogen sulfide gas killed two workers. (on January 14, 1982 MDNR ordered the facility closed.) A second emergency recovery action was required in April 1982, when PCB-contaminated oil was released into the Rochester-Utica State Game and Recreation Area. The third emergency action was initiated in July 1982 to stabilize hazards on-site from high lagoon levels and open flammable tanks. The sequence of events and the constant threats to human health and the environment earned LDI, MDNR's designation as the "second" worst hazardous waste site in the state of Michigan and was ranked 26th by EPA for remedial actions. EPA and MDNR maintained site surveillance over the next several months pending further cleanup. In the early spring of 1983, accumulation of water from heavy rains along with further deterioration of dikes and leaking drums prompted EPA to initiate an "immediate removal action" to stabilize the site. Work was completed on the site in the fall of 1983. The two lagoons were dewatered, solidified and "capped." Deteriorating drums were "overpacked" then removed from the site with the rest of the drums. The cost of the stabilization project was approximately \$2 million. The site is currently waiting for remedial action by EPA

B. The Fire

Beginning on June 3, 1983, feasibility tests were conducted by EPA on the sludge in the waste oil lagoon to determine if lime solidification would be an appropriate process to convert the liquid wastes into solid form. On June 8, 1983, larger scale testing of the sludge produced acceptable results. Thus, on June 13, 1983 EPA began adding lime directly to the waste oil lagoon. This process produced large white clouds of lime dust and subsequent complaints from nearby residents. On June 14, 1983, EPA began injecting the lime beneath the surface of the lagoon in an effort to minimize the large emissions of lime dust. This procedure seemed to be effective, so on June 15, 1983, subsurface injection of lime continued - without incident throughout the morning. At approximately 12:40 p.m., lime injection was abruptly

ordered to a halt by the OSC when a large white cloud was seen coming off the lagoon. An MDNR air quality engineer arrived shortly thereafter and informed the OSC that odors and lime dust were evident in a location approximately one mile from the site. The OSC and the engineer went to investigate that area as well as other locations nearby, however, the cloud had disappeared. Shortly after they returned to LDI (at approximately 1:15 p.m.), the white smoke coming off the lagoon turned black and the lagoon was observed to be on fire, apparently the result of an exothermic reaction. The blaze grew in size and the fire department was summoned. When firefighters arrived, the OSC advised them of the lagoon contents: waste oils, benzene, toluene, xylene and no PCBs.

The OSC established a "hot line" approximately 100 yards from the lagoon, where firefighters set up their equipment. Firefighters entering the area beyond this point were required to wear Self-contained Breathing Apparatus (SCBAs). The OSC and a fire official monitored the "hot line" to ensure that no one entered the area without a SCBA.

Although most of the constituents in the lagoon were adequately known, there was the question of unknown chemical constituents and the potential of hazards from the smoke and fumes from the fire. Although the smoke traveled up and over the recreation area in a relatively vertical path, it still was traveling in the general direction of nearby residential areas. As a precautionary measure, a voluntary evacuation of nearby residents was initiated and subsequently, the entire area surrounding LDI was sealed-off. Firefighters suppressed the fire using foam and at approximately 3:00 p.m., with the flames out, the Fire Chief declared the fire under control and the evacuation was cancelled. One firefighter was treated for smoke inhalation at a nearby hospital when his air tank malfunctioned at the lagoon. There were no other casualties although several firefighters were examined at the hospital after the fire.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

NIOSH was asked to advise fire officials about procedures for cleaning personal protective gear, clothing and other firefighting equipment which may have become contaminated by chemical wastes during the fire. Appropriate methods of decontamination must be based upon the nature of the chemicals the gear, clothing and equipment were exposed to, the degree of contamination or compromised integrity of the item, availability and efficacy of known decontamination methods and the costs of decontaminating methods versus replacing the gear, clothing and equipment.

Based upon exposure information available at the time and due to the large number of chemicals that were involved, EPA authorized complete replacement of personal protective clothing ("turnout" coats, boots, gloves and helmets), some air masks and webbing and straps for SCBAs and some fire hoses.

EPA also collected the following environmental samples subsequent to the fire:

- samples of water, used to wash and decontaminate some of the firefighting equipment

- a composite sample of the waste oil lagoon

- off-site samples of soil, collected a few miles from LDI

- samples from the two fly ash piles and

- background water and soil samples to serve as controls.

These samples were analyzed for tetra through octachlorinated dibenzo-p-dioxins and dibenzofurans

B. Medical

Self-administered medical questionnaires were distributed to thirty-five firefighters and six police officers involved with the LDI fire to determine the extent of ill health effects suffered by the those individuals.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are

often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

VI. RESULTS

A. Environmental

Results of EPA's samples analyzed for tetra through octachlorinated dibenzo-p-dioxins and dibenzofurans are presented in Table I. The compound of most concern, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was not detected in any of the samples submitted for analysis. The limits of detection in these analyses ranged from 0.004-0.001 parts per billion (ppb) depending upon the detection limits calculated for individual tests.

NIOSH obtained a list from EPA of the chemicals known to be present in both the scrubber and waste oil lagoons as of May 1983. The composition of the "scrubber" lagoon was described as; waste water, oil and suspended sediments containing toluene (280 ug/l), xylene (490 ug/l), 1,1,1,-trichloroethane (260 ug/l), trichloroethylene (160 u g/l), perchloroethylene (55 ug/l), oil (160 ug/l), cadmium (120 ug/l), chromium (90 ug/l), copper (890 ug/l), nickel (800 ug/l), lead (310 ug/l), zinc (210 ug/l), and iron (4,800 ug/l). The composition of the waste oil lagoon was described as oil, water and sediments containing; toluene (95,000 ug/l), xylene (5,000

ug/l), styrene (7,800 ug/l), 1,1,1,-trichloroethane (34,000 ug/l), trichloroethylene (15,000 ug/l), perchloroethylene (3,500 ug/l), polychlorinated biphenyl in water (1 ppm), polychlorinated biphenyl in oil (190 ppm), cadmium (5,000 ug/l), chromium (94,000 ug/l), copper (33,000 ug/l), zinc (87,000 ug/l), iron (530,000 ug/l), phenols (3,200 mg/kg) and numerous other organics. There may have been other unknown chemicals present in the waste oil lagoon and new chemicals may have been formed by the interaction of chemicals and the heat of the fire.

Although the firefighters protective gear, clothing and equipment were potentially exposed to many substances, visual examination of some boots, gloves and turnout coats revealed that dried mud and lime dust were the only obvious contaminants. Stains from oils or other liquids were not apparent and the items appeared to be free of holes and other damage that could compromise their protective features.

Although the samples of water used to rinse the equipment after decontamination procedures were entirely negative for TCDDs, EPA authorized replacement of the protective gear, clothing and equipment when it became apparent that the costs of analyzing all of the items for so many compounds would greatly exceed the cost of replacing them.

B. Medical

Self-administered medical questionnaires were obtained for forty of the forty-one individuals involved with the LDI fire. Generally, both the firefighters and the police officers who were at the scene of the fire experienced only minor health effects from exposures associated with smoke and fumes. Significant exposure to smoke and fumes was documented by one firefighter whose air tank malfunctioned at the burning lagoon. This individual was treated for smoke inhalation at a nearby hospital and released. Nose and throat irritation lasting more than six hours after the fire was reported by fifteen individuals, Cough and shortness of breath were reported by eight individuals and five individuals respectively. Nine individuals reported that liquid wastes or sludge penetrated their clothing resulting in prolonged skin contact. Four of these individuals reported experiencing skin irritation or a slight rash. One person, who was not at the fire, reported experiencing a slight rash on his hands after washing some of the air tanks that were used during the fire. After the fire, twenty-five individuals sought medical attention at the emergency room of a nearby hospital. Within this group, nine persons reported no symptoms at all and four persons reported nose and throat irritation as their only symptom. A history of smoking cigarettes was reported by twenty-nine persons, fifteen who currently still smoke. No other epidemiologic data were reported.

VII. DISCUSSIONS AND CONCLUSIONS

The results of the investigation indicate that the individuals involved with the fire suppression activities at the LDI fire experienced only minor symptoms and irritations resulting from exposures during the fire. No one was hospitalized and with the exception of the one firefighter who was treated for smoke inhalation, none of the other firefighters required respiratory therapy. At the time of the medical survey, which was almost one month after the fire, prolonged health effects were not reported. Onset of delayed health effects would not expect to occur based upon the type of exposure and the minor acute symptoms reported. Exposure to liquid chemicals contained in the lagoon was minimal and exposure to smoke and fumes were minimized based upon the vertical ascending path of the smoke, its movement away from the firefighters and the use of breathing apparatus by firefighters at the burning lagoon. The minor skin irritations experienced by some of the firefighters was most likely attributable to skin contact with lime dust and residue.

The issues surrounding the replacement of the clothing, protective gear and equipment are very complicated and require some clarification. In the absence of specific decontamination procedures, each incident such as this, must be addressed separately. In the case of the LDI fire, decontamination of the clothing, protective gear and equipment was complicated by the large number of potential chemicals involved, the absence of rapid testing methods and the high cost of existing testing methods. When weighing the cost of decontamination procedures versus the cost of replacing the clothing, gear and equipment, it appears that from the cost effectiveness point of view, that EPA made an appropriate decision, by authorizing complete replacement. This decision, however, seemed to be interpreted by some individuals as EPA's agreement that the clothing, gear and equipment was, in fact contaminated and therefore unusable. This was not necessarily the case. Replacing the clothing, gear and equipment was authorized because of the excessive time and expense that would have been required to test for the large variety of chemicals known to be contained in the dump, the possibility of the existence or formation of unknown chemical compounds and the length of time firefighters would have had to rely upon backup (and possibly inferior) gear, while waiting for final judgement on their first line-gear. Nevertheless, many individuals expressed a great deal of concern that they might risk serious health effects later-on as a result of having been present at the LDI site during the fire and from continued use of gear and clothing used to suppress the fire. While the concern regarding exposures to hazardous wastes is understandable, it is not possible to predict long-term health outcomes from any of these exposures. Additionally, the precautionary measures implemented by the OSC and the Fire Chief (the establishment of the "hot-line" and required use of SCBA's) may have significantly reduced the opportunity for firefighters to have been exposed to toxic wastes.

Concern and reactions regarding risk of exposure to hazardous wastes was not limited to the firefighters. In another incident related to the LDI fire, an employee of the township's water department was talking to a police officer at the intersection of the main road and the access road to LDI when he suffered what appeared to be a heart attack. Emergency medical personnel took the employee to the emergency room of a nearby hospital. Moments after the person was taken into the emergency room, he was taken back outside on a stretcher by two attendants who removed all but his undershorts, then proceeded to wash the man down with cold water from a garden hose, before taking him back into the emergency room. Medical personnel, thinking the man posed some degree of risk to other individuals because he was "contaminated" from having been at LDI, authorized this procedure. Not only was this measure extreme, but probably unnecessary as well. The man had not been exposed to anything at the LDI site. Additionally, had contamination occurred, rinsing the man with cold water alone, may not have been sufficient to reduce this contamination.

VIII. RECOMMENDATIONS

1. A routine medical screening/surveillance program should be established for firefighters. This program should focus on periodic assessment of cardiac and pulmonary systems and include thorough medical histories, physical examinations, electrocardiograms, pulmonary function tests and chest X-rays when needed. (The hospital emergency room should only be used, when necessary, by firefighters who suffer immediate, acute symptoms from exposures during the course of suppressing a fire. The practice of routinely visiting the hospital emergency room by firefighters who are asymptomatic, should be discontinued unless specific chemical exposure or other information indicate the need for medical evaluation.)
2. Because many firefighters expressed concern about smoke and other substances on their work uniforms affecting family members, firefighters should launder and keep work uniforms at the fire station. Uniforms should be laundered routinely using a separate washer and dryer from the ones used to launder bed linens and towels. For those occasions when firefighters respond to fire alarms from their homes, a backup uniform should be kept at home.
3. Fire hoses and other fire fighting equipment should be cleaned routinely according to the manufacturer's recommendations. To minimize personal exposures from substances on the hoses or equipment and to minimize skin irritations from detergents used during the cleaning procedures, elbow or arm length rubber gloves can be worn.
4. Future consideration for replacing clothing, gear and equipment, believed to be contaminated by harmful chemicals should be based upon: evidence of contamination; damage, limiting or compromising the safety qualities of the clothing, gear or equipment; knowledge of the chemicals and efficacy of known decontamination methods; and the cost of decontamination procedures versus replacement of the articles.

5. Because of the expressed concerns and questions regarding hazardous wastes, an education program about toxic chemicals should be established. The focus of this program should include how chemicals move through the environment, understanding how risks to human health occur, and a perspective on dump sites. This program should be made available to firefighters, police officers, health care personnel, township and other community officials and to the general public. A subsequent training program on fighting chemical fires should also be established.

IX. REFERENCES

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3. Hazard Evaluation and Technical Assistance Report (HETA) 82-115-1101 Fire Department Poughkeepsie, New York, April, 1982
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IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. Shelby Township Fire Department
2. International Association of Fire Fighters
3. NIOSH, Region V
4. OSHA, Region V

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 1

LIQUID DISPOSAL INC., SHELBY TOWNSHIP, MICHIGAN

RESULTS OF HRGC-LRMS ANALYSES OF EXTRACTS OF EPA/REGION V SAMPLES SUBMITTED FOR
TETRA THROUGH OCTACHLORINATED DIBENZO-p-DIOXINS AND DIBENZOFURANSsamples analyzed by Wright State University
(results recorded in parts per billion (ppb))

HETA: 83-326

PARAMETER	Blank (Control)	1/4 mile SW of Dequindre Rd. on Hamlin Rd (Control)	1/8 mile NW of Shelby Rd. on 22 Mi. (Control)	SW corner 22 Mi. Rd & Shelby Road	Composite Waste Oil Lagoon	Bkgnd Rinse Water (Control)	Wash Twp Fire Dept. Rinse Water	Shelby Twp. Fire Dept. Rinse Water	Sterling Hghts. Fire Dept. Rinse Water	East Fly Ash Pile	West Fly Ash Pile
SAMPLE NUMBERS	83EP10S05	83EP10S01	83EP10S02	83EP10S03	83EP10S04	83EP10S06	83EP10S07	83EP10S08	83EP10S09	83CY02S44	83CY02S45
TCDF's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCDD's	ND	ND	ND	ND	ND	ND	ND	ND	1.5*	1.1*	
PCDF's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCDD's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HxCDF's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HxCDD's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HpCDF's	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	1.4
HpCDD's	ND	0.10	0.12	0.07	11.0	ND	ND	ND	ND	5.6	4.7
OCDF's	ND	ND	ND	ND	2.0	ND	ND	ND	ND	1.3	2.3
OCDD's	ND	0.23	0.28	0.08	29.0	ND	ND	ND	ND	6.9	11.4

ND = NOT DETECTED

* NOT DUE TO 2,3,7,8 - TCDD ISOMER

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