U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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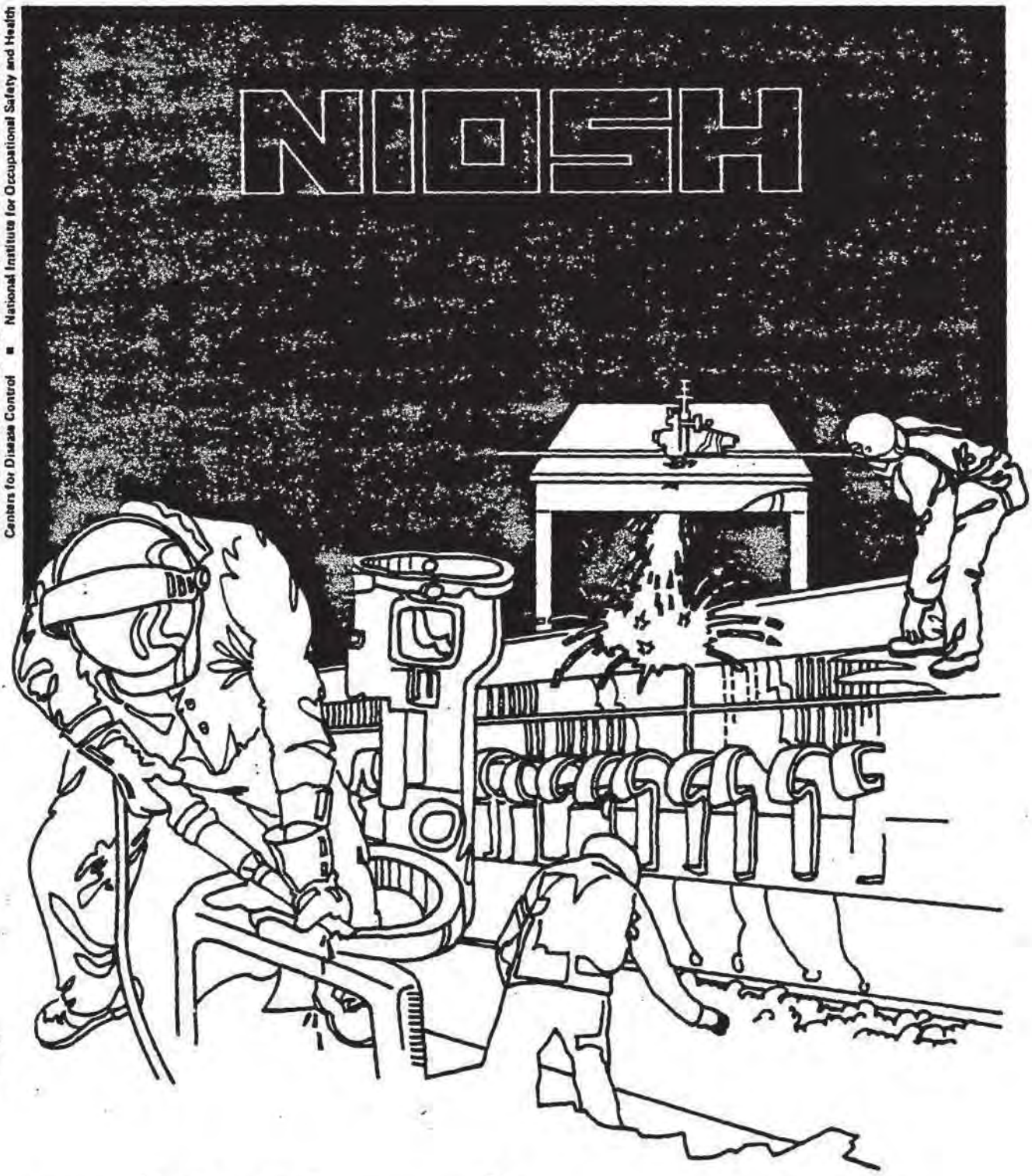

Health Hazard Evaluation Report

HETA 83-307-1561
U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO

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 83-307-1561
JANUARY 1985
U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO

NIOSH INVESTIGATOR
RICHARD J. COSTELLO, I.H.

I. SUMMARY

In June 1983, the National Institute for Occupational Safety and Health (NIOSH) was requested by the U.S. Environmental Protection Agency (as part of an Interagency Agreement) to evaluate the health and safety conditions for EPA employees and contract employees during barrel, tankage, and debris removal operations at the Chem-Dyne Hazardous Waste Site in Hamilton, Ohio.

During the period of June 7 to June 10, 1983, NIOSH investigators collected 195 air samples to characterize airborne exposures in the working environment at the Chem-Dyne Site. Of these 195 samples, 57 were personal samples and 138 were area samples. Of the 138 area samples, 71 were collected by placing sampling devices on heavy equipment and sampling air in the breathing zone of the operator.

The arithmetic mean toluene in air concentration measured in 45 samples was 331 ug/m^3 (maximum 2266 ug/m^3). Xylenes were measured at an arithmetic mean concentration of 276 ug/m^3 (maximum 3047 ug/m^3), ethyl acetate at 111 ug/m^3 (maximum 1563 ug/m^3) and styrene at 48 ug/m^3 (maximum 678 ug/m^3). The metals measured included iron (geometric mean: 4.9 ug/m^3, maximum 26.3 ug/m^3), magnesium (geometric mean: 3.2 ug/m^3, maximum 37 ug/m^3), and tin (geometric mean: 1.5 ug/m^3, maximum 6.2 ug/m^3). Aluminum, calcium, manganese, phosphorus, and zinc were also detected at very low levels. Two samples contained arsenic at an arithmetic mean concentration of 3.3 ug/m^3, lead at an arithmetic mean concentration of 2.9 ug/m^3 as well as low levels of Mo, Pt, Sb, Se, Ti, Te, and Tl. Chloride anion was detected in 14 air samples at a mean concentration of 15.9 ug/m^3 and phosphate anion at a mean concentration of 26.2 ug/m^3. Chlorinated pesticides (31 samples), PCBs (31 samples), PNAs (23 samples) and nitrosamines (27 samples) were not detected.

The concentration of all substances measured were below OSHA regulatory standards. Two sample results (3.0 ug/m^3 and 3.4 ug/m^3) exceeded the NIOSH criteria for a recommended standard for arsenic (2 ug/m^3).

The generally low concentrations of airborne contaminants in the 195 samples collected at this site suggest that chemical exposure during drum removal operations is minimal. The high level of respiratory and skin protection worn further protected workers from occupational exposure to chemicals. Recommendations to improve site safety procedures are given on page 9.

KEYWORDS: SIC 4783 (Packing Goods for Shipping) and SIC 9511 (Air and Water Resources and Solid Waste Management), Hazardous Waste Sites, Air Sampling, Arsenic, Solvents, Toluene.

II. BACKGROUND

In June 1983, the National Institute for Occupational Safety and Health (NIOSH) was requested by the U.S. Environmental Protection Agency (as part of an Interagency Agreement) to evaluate the health and safety conditions for EPA employees and contract employees during drum removal operations at the Chem-Dyne Hazardous Waste Site in Hamilton, Ohio. The Chem-Dyne site covered approximately 10 acres. The site was bounded on the north by a canal, on the west by a factory building, on the east by an open field, and on the south by residential housing. While in operation, the Chem-Dyne facility had been used for storage and reprocessing of hazardous wastes. At the time of the cleanup the site contained 31 above-ground tanks, two below-grade open top tanks, approximately 8600 drums, two tanker trailers, eight semitrailers, one flatbed truck, and one flatbed railroad car.

A planning meeting was held with officials of the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers in Huntington, West Virginia on April 27, 1983 and on site monitoring of occupational exposure was conducted June 7-10, 1983. A preliminary report of results was furnished to interested parties on July 11, 1983.

III. METHODS

A. Evaluation of Existing Data

There were two documents available that listed potential site contaminants: the Emergency Action Plan[1] for the Chem-Dyne site, and the Summary of Existing Bulk, Drum, and Other Waste Information contained in the Corps of Engineers Request for Proposal for the Chem-Dyne Waste Site Remediation[2] contract. These documents indicated that workers would be potentially exposed to a wide variety of chemical substances including volatile organic vapors, particulate metal species, polychlorinated biphenyls, polynuclear aromatic hydrocarbons, nitrosamines, and strong acids and bases.

B. Study Strategy

The strategy used in this study is detailed in the "Protocol to Support an Interagency Agreement between NIOSH and the U.S. EPA".[3] The classes of substances to be sampled were selected after examining available EPA and Corps of Engineer documents. While the probability of release of the volatile organic substances during sampling and bulking operations was high, the probability of release, and subsequent potential worker exposure, to substances other than volatile organic vapors was unknown and therefore these classes of compounds were also measured. Acid mists and vapors were analyzed because they are acute irritants. Organic vapors were analyzed because they are ubiquitous at hazardous waste sites. Metals (elemental analyses) were included because toxic metals had been identified at the Chemdyne Site and because the analytical technique used for this analysis also provided a broad spectrum screening for other elements of potential health concern.

Nitrosamines and PNAs were measured because of their potential carcinogenic properties. Pesticides were measured because these substances can be acutely toxic as well as bio-accumulative.

NIOSH investigators were prepared to monitor for acutely toxic concentrations of chemical substances with the SDRITS (The Simultaneous Direct Reading Indicator Tube System).[4] Acutely toxic agents are those substances that can produce death or serious irreversible injury in a short time frame (minutes). On site chemical analysis for volatile organic vapors was conducted in a trailer modified to serve as a mobile operational base. Additional filters and sorbents were analyzed in fixed laboratory facilities for low level volatile organic vapors.

The use of direct reading instruments and on site screening of sorbent samples for volatile organic vapors was intended to provide "near real time" identification and quantitation of chemical contaminants for use in implementing site health and safety protocols. The samples analyzed in the laboratory were intended to document site conditions and illuminate exposures that may be significant only after more prolonged exposure.

In aggregate, the sorbent and filter samples attempted to bracket the maximum and minimum occupational exposures at the site by measuring maximum contaminant concentrations at the site of active materials handling (the personal samples) and measuring contaminant concentration at the point of least potential occupational exposure (the site boundary). Thus those workers who worked in the immediate vicinity of drums of waste (drum formen, handlers, spotters, and markers, drum staging and bulking workers and utility workers) would be expected to have higher inhalation exposures than those whose job position was near the site boundary (air tenders, drivers, guards, decon shed attendants). The same trend would be anticipated for fixed location samples collected in the vicinity of these job positions at the site perimeter (decon shed, weather station). The samples collected at the site boundary also could be used to evaluate whether the site acted as an area source (which implies that some of the exposure measured in personal samples is not due solely to the unit operation or process involved) and to measure the migration of contaminants away from the site towards other workplaces. The samples collected at the site boundary were also used to determine whether exposures to the public existed.

C. Process Description

The site clean-up project included the removal, consolidation, bulking, and disposal of the liquids (approximately 350,000 gallons), semi-solids (approximately (110,000 gallons) and solids/sludges (approximately 85,000 gallons) contained in the drums and tankage, and various containers in the Chem-Dyne building. The project also included the demolition, removal, and disposal of the drums, tankage shells, trailers, and flatbeds, as well as collection, removal and disposal of debris in the Chem-Dyne building.[5]

During the NIOSH study, three separate activities were underway at the site. The prime contractor had one group of workers pumping bulk liquids from above ground tanks and another group working on the drums - moving, staging, consolidating (bulking), crushing, etc. The second operation, being performed by a subcontractor, involved a hydrogeological survey of the property to determine the extent of contamination. The entire operation was being supervised by the Department of the Army Corps of Engineers.[5]

During periods of active drum handling, workers wore self-contained breathing apparatus or airline respirators, hoods, boots, gloves, hard hats. Chemically resistent splash clothing was worn in the vicinity of open drums and Tyvek in other areas. When drums were not being handled, the respiratory protection requirement was reduced to the use of full face air purifying respirators equipped with particulate/organic vapor cartridges.

D. Air Sampling Protocol

Fixed location area sampling stands were erected at approximate breathing zone height (5 feet above ground level) adjacent to the commercial building north of the site (Figure 1). Additional sampling was conducted upwind and downwind of the drum sampling area (Areas 3 and 4) and inside a fire-damaged structure (Area 2). All sampling stands were positioned to avoid active roadways and to avoid interference with site activities.

Personal samples which drew air from the breathing zone (the portion of the body roughly defined by the nose and the collar bone) were attached to individual workers whose activities were within the test area. These included laborers and foremen, heavy equipment operators, EPA employees, and NIOSH employees. 57 personal samples were collected during 4 separate sampling days. A battery operated pump, which was attached to the workman's belt or SCBA harness, drew air through the sample collection media. The sampling devices were removed during lunch breaks and when the workers left the site. The number of samples collected at each fixed location and among workers in each job category and the target analyte(s) are summarized in Table 1.

E. Analytical Methods

All samples were analyzed by NIOSH or by NIOSH contract laboratories. The analytical methods used and the limits of detection achieved in this study are summarized in Appendix I.

Eight samples collected for organic vapor analysis were analyzed by gas chromatography and mass spectrometry (GC/MS). Ethyl acetate, 1,2-dichloroethane, toluene, xylenes, n-propyl acetate, isopropyl acetate, styrene, and MIBK were detected. Twenty foor additional samples were analyzed for the major contaminants detected in the X samples analyzed by GC/MS.

All 24 samples analyzed for elemental analysis were screened by inductively coupled plasma atomic emission spectrometry for a standard array of 32 elements including aluminum, arsenic, barium, beryllium, cadmium, calcium, cobalt, chromium, copper, iron, lanthanum, lithium, magnesium, manganese, molybdenum, sodium, nickel, phosphorus, lead, platinum, antimony, selenium, silver, tin, strontium, titanium, tellurium, thallium, vanadium, yttrium, and zinc, zirconium.

The following 31 pesticides were quantitated by gas chromatograph equipped with an electron capture detector: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane. Six species of PCBs were quantitated by gas chromatograph equipped with an electrolytic conductivity detector: Aroclor 1016, Aroclor 1211, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260. Six PNAs were quantitated by high performance liquid chromatography. The limit of detection was 50 ng/sample for Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(e)pyrene, and Benzo(a)pyrene. Nitrosamines were not detected in any of the 27 samples analyzed by gas chromatograph equipped with a Thermo Energy Anaylzer.

F. Statistics Analysis

Descriptive statistics, such as the number of observations, arithmetric mean, standard deviation, maximum and minimum values and geometric mean are given in Tables 8 to 29 and 31 to 35 for each day, job and groups.

The distribution of each substance was checked against normal and log-normal distribution. Sapiro Wills' W-statistics was used as test-statistics for the substance with sample size less than 51, and komogorov's D-statictics for those with sample size greater than or equal to 51.

To test day, job and group differences, analysis of variance (ANOVA) was used for those substances that fulfill normality assumption in either original or log scale (i.e normally or log-normally distributed). Substances with neither normal nor log-normal distribution were tested with Kruskal - Wallis' Chi-square statistics.

In the text, central tendency, such as mean or geometric mean was quoted in a way that can be properly used to interpret hypothesis test results in the original scale.

IV. EVALUATION 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. These criteria are presented in Appendix II. 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.

V. RESULTS

A. Weather Data

The field weather observations were made at 15 minute intervals and recorded on magnetic tape. The data was processed with computer assistance. Air temperatures during the sampling days varied between 10-25 C during June 7th, 11-26 C during June 8th, 11-28 C during June 9th, and 13-25 C during June 10th. Winds were generally less than 15 miles per hour during the study. There was no measurable rain during the study period. Summaries of air temperatures, wind speed, and wind direction are presented in Table 2.

B. Volatile Organic Vapors

The arithmetic mean toluene in air concentration measured in 45 samples was 331 ug/m^3 (maximum 2266 ug/m^3). Xylenes were measured at an arithmetic mean concentration of 276 ug/m^3 (maximum 3047 ug/m^3), ethyl acetate at 111 ug/m^3 (maximum 1563 ug/m^3) and styrene at 48 ug/m^3 (maximum 678 ug/m^3).

C. Elemental Analyses

The sample populations of aluminum, calcium, iron, magnesium, and tin were log-normally distributed. Metals were detected in 24 air samples at very low levels. The metals measured included iron (geometric mean: 4.9 ug/m^3, maximum 26.3 ug/m^3), magnesium (geometric mean: 3.2 ug/m^3, maximum 37 ug/m^3), and tin (geometric mean: 1.5 ug/m^3, maximum 6.2 ug/m^3). Aluminum, calcium, manganese, phosphorus, and zinc were also detected at very low levels. Twenty-two additional elemental analysis were accomplished for each sample, but the analytes were always less then the detection limit for Ag, Ba, Be, Cd, Co, La, Li, Na, Sr, V, Y, Zr.

Two samples contained relatively high concentrations of particulate contaminants. These included arsenic at an arithmetic mean concentration of 3.2 ug/m^3, lead at an arithmetic mean concentration of 2.9 ug/m^3 as well as low levels of Mo, Pt, Sb, Se, Ti, Te, and Tl. One of these samples was collected in the contractor laboratory trailer and the second in the dressing shed.

D. Acid Anions

The sample populations of chloride and phosphate anions were normally distributed. Chloride anion was detected in 14 air samples at a mean concentration of 15.9 ug/m^3, maximum 50.0 ug/m^3; and phosphate anion at a mean concentration of 26.2 ug/m^3, maximum 21.3 ug/m^3.

E. Other Substances

The following pesticides were quantitated in 31 samples, but the analytes were all less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane. Six species of PCBs were quantitated in 31 samples, but the analytes were all less then the detection limit: Aroclor 1016, Aroclor 1211, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260. Six PNAs were quantitated in 23 samples, but the analytes were all less then the detection limit: Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(e)pyrene, and Benzo(a)pyrene. Nitrosamines were not detected in any of the 27 samples analyzed.

F. Direct Reading Instruments

An incident of respiratory and mucous membrane irritation among employees at the factory north which was attributed to airborne migration of contaminants from the Chemdyne site was investigated on June 9th. The NIOSH Simultaneous Direct Reading Indicator Tube System (SDRITS) identified a ketone and an acid reading substance at the fenceline between the factory and the site. The positive ketone result is consistent with the MIBK identified in concurrent charcoal tube samples. The reported symptoms were consistent with the categories of materials identified by the SDRITS. This incident indicates the utility of the SDRITS for rapidly assessing the migration of contaminants from the site to near-by areas.

VI. DISCUSSION

The results of the air samples sorted by day are presented in Tables 3 to 7. The results of the air samples sorted alphabetically by job category or fixed location description are presented in Tables 8 to 29.

The airborne contaminant concentrations did not increase systematically between the sampling days. The concentration of 7 substances (chloride anions, phosphate anions, isopropyl acetate, MIBK, n-propyl acetate, sodium and zinc) differered significantly among the sampling days. The concentration of chloride and phosphate anions were highest on the last sampling day and lowest on the first day. The concentration of sodium, zinc and MIBK was highest on the first sampling day. The concentration of isopropyl acetate and n-propyl acetate were highest on the fourth sampling day. The concentration the other substances quantitated were either all below the limit of detection or the differences between days were not statistically different.

There were statistically significant differences between jobs for 5 substances. The Backhoe operator had the highest mean exposures to aluminum (geometric mean: 16.5 ug/m^3), calcium (geometric mean: 82.5 ug/m^3), iron (geometric mean 25.5 ug/m^3, and magnesium (geometric mean: 21.1 ug/m^3). The highest exposure to manganese was in the dressing shed.

Finally the air sampling data was grouped into categories based on the proximity of the worksite to areas of active handling of chemically contaminated materials. It was anticipated that workers nearest the site of active material handling would have the highest exposures and that the mean concentration of airborne contaminants would decrease in both the personal and area samples more distant from major exposure sources. It was anticipated that the laboratory trailers would have the lowest mean exposures because of the controlled climate and assess to these areas. Table 30 gives the composition of each of these groups.

There were no difference in exposure to chloride and phosphate anions among the five categories. Exposures to aluminum and iron were different: the airborne concentrations were highest among the heavy equipment operations.

There were differences in exposure to many of the volatile organic compounds including ethyl acetate, styrene, toluene, and xylenes. The high exposure personal category was most exposed to each of these 4 substances and either the laboratory or area category was least exposed. The low exposure personal category had the greatest exposure to both zinc and MIBK. The area category was least exposed to MIBK and heavy equipment operators were least exposed to zinc.

VII. CONCLUSIONS

The generally low concentrations of airborne contaminants in the 195 samples collected at this site suggest that chemical exposure during drum removal operations are minimal. This finding is consistent with previous NIOSH studies at similar sites.[6,7] The high level of respiratory and skin protection worn further reduced occupational exposure to chemicals. Although the protective clothing worn could induce heat stress, the maximum air temperatures encountered during this study (76-83'F) were relatively mild. However, warmer temperatures were anticipated during the summer months.

The only indications of potential chemical overexposure were two sample results (3.0 ug/m^3 and 3.4 ug/m^3) in which the NIOSH criteria for a recommended standard for arsenic exposure (2 ug/m^3) was exceeded. These exposures did not exceed the OSHA regulatory standard for arsenic. Since one of these samples was collected inside of the contractor laboratory trailer, which was well equipped with exhaust hoods and other safety devices, the on-site sampling handling procedures should be reexamined.

VIII. REFERENCES

1. Harsh, K. Emergency Action Plan: Chem-Dyne Hamilton, Ohio (1981).

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report have been sent to:

1. U.S. Environmental Protection Agency, 401 "M" Street S.W., Washington, D.C. 20460.
2. U.S. Environmental Protection Agency, Region V, 230 South Dearborn Street, Chicago, Illinois 60604.
3. O.H. Materials Co., P.O. Box 551, Findlay, Ohio 45840.
4. NIOSH Region V
5. OSHA Region V

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22151. Information regarding its availability through NTIS can be obtained from NIOSH publications at the Cincinnati address.

TABLE 1

SAMPLING PROTOCOL

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

	NUMBER OF SAMPLES							
	ELEMENTAL ANALYSIS	ORGANIC VAPORS	ACID ANIONS	POLYNUCLEAR AROMATIC HYDROCARBONS	POLYCHLORINATED BIPHENYLS	PESTICIDES	NITROSAMINES	ROW TOTAL
PERSONAL SAMPLES								
AIR TENDER		1	2			2		5
DRIVER		1						1
DRUM FOREMAN					1			1
DRUM HANDLER		2			1	1		4
DRUM SPOTTER		1						1
GUARD		7						7
INDUSTRIAL HYGIENIST		2						2
MARKING DRUMS		2			1			3
SAMPLE CHEMIST	2				2	2	2	8
STAGING		1	2	1				4
UTILITY WORKERS	3	2	2	2	4	5	3	21
AREA SAMPLES								
AREA #1	3	4	1	4	3	3	3	21
AREA #2						3		3
AREA #3		1		1	1	2	1	6
AREA #4		1		1	1	1	1	5
BACKHOE	2	3		2	3	3	3	16
BARREL GRABBER	4	6	2	5	6	6	5	34
BOBCAT			1					1
DRESSING SHED	3	2	2	1	1		3	12
FRONT END LOADER	3	3	1	3	4	3	3	20
NIOSH TRAILER		2	1		1		1	5
OHM LAB	4	4		2	2		1	13
WEATHER STATION				1			1	2
OLUMN TOTAL	24	45	14	23	31	31	27	195

TABLE 2

WEATHER DATA

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

COMPASS POINT	NO of OBS	% of OBS	MEAN VELOCITY (MILES PER HR)	MEAN & STD DEV of WIND DIRECTION	MAX TEMP (DEGREES CELCIUS)	MIN TEMP (DEGREES CELCIUS)	MEAN TEMP (DEGREES CELCIUS)
6/7/83							
E	1	2.1	3.3	279/92	24.9	10.2	19.4
SSE	2	4.2	0.8				
S	4	8.3	0.8				
SSW	5	10.4	0.7				
SW	8	16.7	1.3				
WSW	6	12.5	1.9				
W	13	27.1	2.5				
WNW	7	14.6	2.1				
NW	2	4.2	2.5				
6/8/84							
N	2	4.2	1.1	48/29	26.4	10.6	20.8
NNE	9	18.8	1.3				
NE	13	27.1	1.2				
ENE	14	29.1	1.1				
E	7	14.6	.9				
NW	1	2.1	1.4				
NNW	1	2.1	1.2				
6/9/83							
NE	5	10.4	0.9	342/119	28.2	11.2	22.2
ENE	8	16.7	0.7				
E	3	6.3	1.2				
ESE	2	4.2	1.2				
SE	2	4.2	1.3				
SSE	3	6.3	1.6				
S	3	6.3	1.3				
SSW	4	8.3	1.6				
SW	10	20.8	1.9				
WSW	5	10.4	1.7				
W	3	6.3	1.5				

TABLE 2
(CONTINUED)
WEATHER DATA

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

COMPASS POINT	NO of OBS	% of OBS	MEAN VELOCITY (MILES PER HR)	MEAN & STD DEV of WIND DIRECTION	MAX TEMP (DEGREES CELCIUS)	MIN TEMP (DEGREES CELCIUS)	MEAN TEMP (DEGREES CELCIUS)
6/10/83							
NNE	1	5	0.6	83/52	28.2	11.2	22.2
NE	6	30	0.8				
ENE	5	25	0.5				
E	5	25	0.5				
SSE	1	5	0.4				
SSW	1	5	1.0				
SW	1	5	1.1				

TABLE 3

EXPOSURE RESULTS
ALL DAYS

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	14	14	ND			
CHLORIDE	14	6	15.9	3.1	50.0	10.2
NITRATE	14	14	ND			
PHOSPHATE	14	5	26.2	7.8	55.2	21.3
SULFATE	14	14	ND			
ELEMENTAL ANALYSES						
ALUMINUM	24	3	8.0	0.4	36.3	4.3
ANTIMONY	24	22	0.9	0.4	5.4	0.6
ARSENIC	24	22	0.8	0.4	3.3	0.6
CALCIUM	24	0	24.4	1.0	99.8	13.6
IRON	24	0	8.2	0.1	26.3	4.9
LEAD	24	22	0.7	0.4	3.3	0.6
MAGNESIUM	24	4	6.5	0.4	36.7	3.2
MANGANESE	24	22	0.7	0.4	3.0	0.6
MOLYBDENUM	24	23	0.6	0.4	1.2	0.5
PHORPHORUS	24	14	1.3	0.4	8.5	0.9
PLATINUM	24	22	0.7	0.4	2.4	0.6
SELENIUM	24	22	0.7	0.4	2.9	0.6
SODIUM	24	23	0.6	0.4	2.7	0.5
TELLURIUM	24	22	1.0	0.4	6.5	0.6
THALLIUM	24	22	0.6	0.4	1.9	0.6
TIN	24	9	2.1	0.4	6.2	1.5
TITANIUM	24	23	0.6	0.4	1.3	0.5
ZINC	24	21	0.7	0.4	2.9	0.6
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	45	37	80.0	16.3	370.4	65.3
ETHYL ACETATE	45	30	158.8	16.3	1562.5	94.7
ISOPROPYL ACETATE	45	42	69.8	16.3	208.3	59.5
MIBK	45	44	64.3	16.3	208.3	56.0
N-PROPYL ACETATE	45	37	83.1	16.3	259.7	68.4
STYRENE	45	39	105.8	16.3	678.0	72.5
TOLUENE	45	24	368.2	16.3	2265.6	154.3
XYLENES	45	26	314.0	16.3	3046.9	135.8
OTHER SUBSTANCES						
NITROSAMINES	27	27	ND			
PCBs	31	31	ND			
PESTICIDES	31	31	ND			
PNAS	23	23	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 4

EXPOSURE RESULTS
JUNE 7, 1984

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	6	6	ND			
CHLORIDE	6	4	5.5	3.1	9.9	4.7
NITRATE	6	6	ND			
PHOSPHATE	6	3	14.5	7.8	23.1	13.0
SULFATE	6	6	ND			
ELEMENTAL ANALYSES						
ALUMINUM	5	0	10.8	4.0	18.5	9.4
ANTIMONY	5	4	1.4	0.4	4.1	1.0
ARSENIC	5	4	1.2	0.4	3.2	0.9
CALCIUM	5	0	25.0	8.9	38.0	21.8
IRON	5	0	11.0	2.2	22.2	8.0
LEAD	5	4	1.1	0.4	2.6	0.9
MAGNESIUM	5	1	6.5	1.0	9.6	5.2
MANGANESE	5	5	ND			
MOLYBDENUM	5	4	0.8	0.4	1.2	0.8
PHORPHORUS	5	2	1.5	0.5	2.7	1.3
PLATINUM	5	4	1.0	0.4	2.1	0.8
SELENIUM	5	4	1.0	0.4	2.3	0.9
SODIUM	5	4	1.1	0.5	2.7	0.9
TELLURIUM	5	4	1.6	0.4	5.3	1.0
THALLIUM	5	4	0.9	0.4	1.7	0 8
TIN	5	1	2.3	1.0	5.3	1.9
TITANIUM	5	5	ND			
ZINC	5	2	1.7	0.5	2.9	1.4
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	10	9	67.8	16.3	208.3	54.3
ETHYL ACETATE	10	9	77.0	16.3	208.3	58.2
ISOPROPYL ACETATE	10	10	ND			
MIBK	10	10	ND			
N-PROPYL ACETATE	10	9	67.8	16.3	208.3	54.3
STYRENE	10	9	77.0	16.3	208.3	58.2
TOLUENE	10	8	119.7	16.3	463.0	73.2
XYLENES	10	9	123.3	16.3	648.1	65.9
OTHER SUBSTANCES						
NITROSAMINES	6	6	ND			
PCBs	8	8	ND			
PESTICIDES	10	10	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

* Indicates a special analysis, not performed on the remainder of the samples of the same type.

TABLE 5

EXPOSURE RESULTS
JUNE 8, 1984

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ELEMENTAL ANALYSES						
ALUMINUM	10	1	4.9	0.4	17.2	3.0
ANTIMONY	10	10	ND			
ARSENIC	10	10	ND			
CALCIUM	10	0	17.2	1.0	68.3	7.9
IRON	10	0	7.0	1.3	26.3	4.9
LEAD	10	10	ND			
MAGNESIUM	10	2	4.0	0.4	17.6	2.0
MANGANESE	10	10	ND			
MOLYBDENUM	10	10	ND			
PHORPHORUS	10	7	0.8	0.4	2.3	0.7
PLATINUM	10	10	ND			
SELENIUM	10	10	ND			
SODIUM	10	10	ND			
TELLURIUM	10	10	ND			
THALLIUM	10	10	ND			
TITANIUM	10	10	ND			
TIN	10	3	1.9	0.4	4.2	1.5
ZINC	10	10	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	12	9	67.9	37.9	188.7	60.4
ETHYL ACETATE	12	7	125.1	36.5	322.6	88.4
ISOPROPYL ACETATE	12	12	ND			
MIBK	12	12	ND			
N-PROPYL ACETATE	12	8	83.6	37.9	188.7	71.9
STYRENE	12	9	118.6	37.9	438.0	79.5
TOLUENE	12	7	231.0	37.9	887.1	120.2
XYLENES	12	7	235.8	37.9	802.9	125.3
OTHER SUBSTANCES						
NITROSAMINES	10	10	ND			
PCBs	11	11	ND			
PESTICIDES	9	9	ND			
PNAS	12	12	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 6

EXPOSURE RESULTS
JUNE 9, 1984

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ELEMENTAL ANALYSES						
ALUMINUM	9	2	9.8	0.5	36.3	4.1
ANTIMONY	9	8	1.0	0.4	5.4	0.6
ARSENIC	9	8	0.8	0.4	3.3	0.6
CALCIUM	9	0	32.2	3.5	99.8	19.2
IRON	9	0	7.9	0.1	24.7	3.6
LEAD	9	8	0.8	0.4	3.3	0.6
MAGNESIUM	9	1	9.2	0.5	36.7	4.1
MANGANESE	9	7	0.9	0.4	3.0	0.7
MOLYBDENUM	9	9	ND			
PHORPHORUS	9	5	1.7	0.4	8.5	1.0
PLATINUM	9	8	0.7	0.4	2.4	0.6
SELENIUM	9	8	0.7	0.4	2.9	0.6
SODIUM	9	9	ND			
TELLURIUM	9	8	1.1	0.4	6.5	0.6
THALLIUM	9	8	0.6	0.4	1.9	0.5
TIN	9	5	2.1	0.4	6.2	1.2
TITANIUM	9	8	0.6	0.4	1.3	0.5
ZINC	9	9	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	15	11	81.7	27.6	370.4	62.1
ETHYL ACETATE	15	8	239.4	43.9	1562.5	110.9
ISOPROPYL ACETATE	15	12	68.5	27.6	177.0	59.6
MIBK	15	14	52.1	27.6	88.5	49.3
N-PROPYL ACETATE	15	13	65.4	27.6	169.5	56.6
STYRENE	15	13	112.2	27.6	678.0	65.0
TOLUENE	15	5	586.0	39.7	2265.6	228.8
XYLENES	15	7	497.8	39.7	3046.9	173.8
OTHER SUBSTANCES						
NITROSAMINES	5	5	ND			
PCBs	7	7	ND			
PESTICIDES	8	8	ND			
PNAS	6	6	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

* Indicates a special analysis, not performed on the remainder of the samples of the same type.

TABLE 7

EXPOSURE RESULTS
JUNE 10, 1984

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	8	8	ND			
CHLORIDE	8	2	23.8	4.8	50.0	18.2
NITRATE	8	8	ND			
PHOSPHATE	8	2	35.0	11.9	55.2	30.8
SULFATE	8	8	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	8	8	ND			
ETHYL ACETATE	8	6	160.4	64.9	274.0	143.9
ISOPROPYL ACETATE	8	8	ND			
MIBK	8	8	ND			
N-PROPYL ACETATE	8	7	134.7	64.9	259.7	120.9
STYRENE	8	8	ND			
TOLUENE	8	4	476.2	64.9	1428.6	272.3
XYLENES	8	3	325.0	84.7	909.1	237.9
OTHER SUBSTANCES						
NITROSAMINES	6	6	ND			
PCBs	5	5	ND			
PESTICIDES	4	4	ND			
PNAS	5	5	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 8

EXPOSURE RESULTS
BY JOB CATEGORY
AIR TENDER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ACID ANIONS						
BROMIDE	2	2	ND			
CHLORIDE	2	2	ND			
NITRATE	2	2	ND			
PHOSPHATE	2	2	ND			
SULFATE	2	2	ND			
VOLATILE ORGANIC VAPORS						
DICHLOROETHANE	1	1	ND			
ETHYL ACETATE	1	1	ND			
ISOPROPYL ACETATE	1	1	ND			
MIBK	1	1	ND			
N-PROPYL ACETATE	1	1	ND			
STYRENE	1	1	ND			
TOLUENE	1	0	283.0	283.0	283.0	
XYLENES	1	1	ND			
OTHER SUBSTANCES						
PESTICIDES	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

TABLE 9

EXPOSURE RESULTS
BY JOB CATEGORY
AREA #1

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	1	ND			
NITRATE	1	1	ND			
PHOSPHATE	1	1	ND			
SULFATE	1	1	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	2	1.1	0.4	2.4	0.8
ANTIMONY	3	3	ND			
ARSENIC	3	3	ND			
CALCIUM	3	0	10.2	4.6	19.9	8.3
IRON	3	0	3.4	0.8	6.8	2.4
LEAD	3	3	ND			
MAGNESIUM	3	0	1.9	1.0	3.8	1.6
MANGANESE	3	3	ND			
MOLYBDENUM	3	3	ND			
PHORPHORUS	3	3	ND			
PLATINUM	3	3	ND			
SELENIUM	3	3	ND			
SODIUM	3	3	ND			
TELLURIUM	3	3	ND			
THALLIUM	3	3	ND			
TIN	3	1	2.7	0.5	4.3	1.9
TITANIUM	3	3	ND			
ZINC	3	3	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	4	4	ND			
ETHYL ACETATE	4	2	89.1	40.7	156.3	79.7
ISOPROPYL ACETATE	4	4	ND			
MIBK	4	4	ND			
N-PROPYL ACETATE	4	4	ND			
STYRENE	4	4	ND			
TOLUENE	4	3	119.1	39.7	240.0	88.2
XYLENES	4	2	158.2	39.7	312.5	104.9
PCBs	3	3	ND			

TABLE 9
(CONTINUED)

EXPOSURE RESULTS
BY JOB CATEGORY
AREA #1

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
PESTICIDES	3	3	ND			
PCBs	3	3	ND			
PNAS	4	4	ND			
NITROSAMINES	3	3	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 10

EXPOSURE RESULTS
BY JOB CATEGORY
AREA #2

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
PESTICIDES	3	3	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

TABLE 11

EXPOSURE RESULTS
BY JOB CATEGORY
AREA #3

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	1	1	ND			
ETHYL ACETATE	1	0	322.6	322.6	322.6	.
ISOPROPYL ACETATE	1	1	ND			
MIBK	1	1	ND			
N-PROPYL ACETATE	1	0	80.6	80.6	80.6	.
STYRENE	1	1	ND			
TOLUENE	1	0	887.1	887.1	887.1	.
XYLENES	1	0	241.9	241.9	241.9	.
OTHER SUBSTANCES						
NITROSAMINES	1	1	ND			
PCBs	1	1	ND			
PESTICIDES	2	2	ND			
PNAS	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 12

EXPOSURE RESULTS
BY JOB CATEGORY
AREA #4

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	1	1	ND			
ETHYL ACETATE	1	1	ND			
ISOPROPYL ACETATE	1	1	ND			
MIBK	1	1	ND			
N-PROPYL ACETATE	1	1	ND			
STYRENE	1	1	ND			
TOLUENE	1	1	ND			
XYLENES	1	1	ND			
OTHER SUBSTANCES						
NITROSAMINES	1	1	ND			
PCBs	1	1	ND			
PESTICIDES	1	1	ND			
PNAS	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 13

EXPOSURE RESULTS
BY JOB CATEGORY
BACKHOE

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ELEMENTAL ANALYSES						
ALUMINUM	2	0	16.6	15.9	17.2	16.5
ANTIMONY	2	2	ND			
ARSENIC	2	2	ND			
CALCIUM	2	0	84.0	68.3	99.8	82.5
IRON	2	0	25.5	24.7	26.3	25.5
LEAD	2	2	ND			
MAGNESIUM	2	0	21.5	17.6	25.3	21.1
MANGANESE	2	1	1.3	0.5	2.1	1.0
MOLYBDENUM	2	2	ND			
PHORPHORUS	2	0	2.0	1.8	2.3	2.0
PLATINUM	2	2	ND			
SELENIUM	2	2	ND			
SODIUM	2	2	ND			
TELLURIUM	2	2	ND			
THALLIUM	2	2	ND			
TIN	2	1	1.4	0.4	2.3	1.0
TITANIUM	2	2	ND			
ZINC	2	2	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	3	2	52.3	40.3	73.0	52.6
ETHYL ACETATE	3	2	190.0	36.5	483.9	95.6
ISOPROPYL ACETATE	3	2	55.6	36.5	80.6	52.6
MIBK	3	3	ND			
N-PROPYL ACETATE	3	2	78.6	40.3	146.0	66.3
STYRENE	3	2	175.9	40.3	438.0	95.6
TOLUENE	3	0	564.0	198.0	1129.0	433.7
XYLENES	3	1	445.4	49.5	802.9	267.9
OTHER SUBSTANCES						
NITROSAMINES	3	3	ND			
PCBs	3	3	ND			
PESTICIDES	3	3	ND			
PNAS	2	2	ND			

NOTE:
1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.
2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.
3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.
4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.
5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 14

EXPOSURE RESULTS
BY JOB CATEGORY
BARREL GRABBER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ACID ANIONS						
BROMIDE	2	2	ND			
CHLORIDE	2	1	14.8	3.1	26.5	9.1
NITRATE	2	2	ND			
PHOSPHATE	2	1	22.4	7.8	37.0	17.0
SULFATE	2	2	ND			
ELEMENTAL ANALYSES						
ALUMINUM	4	0	12.1	2.0	36.3	6.6
ANTIMONY	4	4	ND			
ARSENIC	4	4	ND			
CALCIUM	4	0	12.3	5.4	19.3	10.6
IRON	4	0	5.3	4.2	6.6	5.2
LEAD	4	4	ND			
MAGNESIUM	4	0	2.7	1.3	4.3	2.4
MANGANESE	4	4	ND			
MOLYBDENUM	4	4	ND			
PHORPHORUS	4	1	1.2	0.4	1.5	1.0
PLATINUM	4	4	ND			
SELENIUM	4	4	ND			
SODIUM	4	4	ND			
TELLURIUM	4	4	ND			
THALLIUM	4	4	ND			
TIN	4	1	2.0	0.4	3.7	1.5
TITANIUM	4	4	ND			
ZINC	4	4	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	6	3	117.5	38.5	370.4	86.7
ETHYL ACETATE	6	2	402.5	38.5	1562.5	202.0
ISOPROPYL ACETATE	6	5	78.0	37.3	156.3	68.8
MIBK	6	6	ND			
N-PROPYL ACETATE	6	4	96.6	38.5	156.3	86.7
STYRENE	6	5	89.5	38.5	223.9	73.6
TOLUENE	6	2	758.0	38.5	2265.6	350.3
XYLENES	6	2	754.3	38.5	3046.9	304.3

TABLE 14
(CONTINUED)

EXPOSURE RESULTS
BY JOB CATEGORY
BARREL GRABBER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
NITROSAMINES	5	5	ND			
PCBs	6	6	ND			
PESTICIDES	6	6	ND			
PNAS	5	5	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 15

EXPOSURE RESULTS
BY JOB CATEGORY
BOBCAT

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	0	32.7	32.7	32.7	.
NITRATE	1	1	ND			
PHOSPHATE	1	0	50.9	50.9	50.9	.
SULFATE	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

TABLE 16

EXPOSURE RESULTS
BY JOB CATEGORY
DRESSING SHED

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	2	2	ND			
CHLORIDE	2	0	9.9	9.9	9.9	9.9
NITRATE	2	2	ND			
PHOSPHATE	2	0	19.8	19.8	19.8	19.8
SULFATE	2	2	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	0	8.1	4.9	12.8	7.4
ANTIMONY	2	1	2.9	0.4	5.4	1.5
ARSENIC	2	1	1.9	0.4	3.3	1.2
CALCIUM	3	0	25.3	15.5	38.0	23.6
IRON	3	0	10.8	3.9	22.2	8.2
LEAD	2	1	1.9	0.4	3.3	1.2
MAGNESIUM	3	1	5.0	1.0	9.6	3.5
MANGANESE	3	3	ND			
MOLYBDENUM	2	2	ND			
PHORPHORUS	3	2	1.2	0.6	2.2	1.1
PLATINUM	2	1	1.4	0.4	2.4	1.0
SELENIUM	2	1	1.7	0.4	2.9	1.1
SODIUM	3	3	ND			
TELLURIUM	2	1	3.5	0.4	6.5	1.7
THALLIUM	2	1	1.2	0.4	1.9	0.9
TIN	3	1	2.7	1.0	5.3	2.1
TITANIUM	2	1	0.9	0.4	1.3	0.8
ZINC	3	2	1.2	0.6	2.2	1.1
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	2	ND			
ETHYL ACETATE	2	2	ND			
ISOPROPYL ACETATE	2	2	ND			
MIBK	2	2	ND			
N-PROPYL ACETATE	2	2	ND			
STYRENE	2	2	ND			
TOLUENE	2	1	74.8	50.5	99.0	70.7
XYLENE	2	2	ND			
OTHER SUBSTANCES						
NITROSAMINES	3	3	ND			
PCBs	1	1	ND			
PNAS	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 17

EXPOSURE RESULTS
BY JOB CATEGORY
DRIVER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	1	1	ND			
ETHYL ACETATE	1	1	ND			
ISOPROPYL ACETATE	1	1	ND			
MIBK	1	1	ND			
N-PROPYL ACETATE	1	1	ND			
STYRENE	1	1	ND			
TOLUENE	1	1	ND			
XYLENES	1	1	ND			
OTHER SUBSTANCES						
PCBs	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

TABLE 18

EXPOSURE RESULTS
BY JOB CATEGORY
DRUM HANDLER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	1	180.5	172.4	188.7	180.4
ETHYL ACETATE	2	1	227.7	172.4	283.0	220.9
ISOPROPYL ACETATE	2	2	ND			
MIBK	2	2	ND			
N-PROPYL ACETATE	2	1	180.5	172.4	188.7	180.4
STYRENE	2	1	227.7	172.4	283.0	220.9
TOLUENE	2	0	847.4	264.5	1034.5	826.5
XYLENES	2	0	549.8	344.8	754.7	510.1
OTHER SUBSTANCES						
PCBs	1	1	ND			
PESTICIDES	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

TABLE 19

EXPOSURE RESULTS
BY JOB CATEGORY
DRUM SPOTTER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	1	1	0.1	0.1	0.1	.
ETHYL ACETATE	1	1	0.1	0.1	0.1	.
ISOPROPYL ACETATE	1	1	0.1	0.1	0.1	.
MIBK	1	1	0.1	0.1	0.1	.
N-PROPYL ACETATE	1	1	0.1	0.1	0.1	.
STYRENE	1	1	0.1	0.1	0.1	.
TOLUENE	1	1	0.1	0.1	0.1	.
XYLENES	1	1	0.1	0.1	0.1	.

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

TABLE 20

EXPOSURE RESULTS
BY JOB CATEGORY
FRONT-END LOADER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	0	25.5	25.5	25.5	.
NITRATE	1	1	ND			
PHOSPHATE	1	0	35.7	35.7	35.7	.
SULFATE	1	1	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	0	7.2	4.5	12.3	6.5
ANTIMONY	3	3	ND			
ARSENIC	3	3	ND			
CALCIUM	3	0	18.4	11.8	25.9	17.5
IRON	3	0	9.7	7.7	11.7	9.6
LEAD	3	3	ND			
MAGNESIUM	3	0	4.6	3.1	6.6	4.3
MANGANESE	3	3	ND			
MOLYBDENUM	3	3	ND			
PHORPHORUS	3	1	0.9	0.4	1.2	0.8
PLATINUM	3	3	ND			
SELENIUM	3	3	ND			
SODIUM	3	2	1.2	0.4	2.7	0.8
TELLURIUM	3	3	ND			
THALLIUM	3	3	ND			
TIN	3	1	2.4	0.4	4.2	1.7
TITANIUM	3	3	ND			
ZINC	3	2	1.0	0.4	2.1	0.7
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	3	3	ND			
ETHYL ACETATE	3	1	118.5	40.7	259.7	83.6
ISOPROPYL ACETATE	3	3	ND			
MIBK	3	3	ND			
N-PROPYL ACETATE	3	2	109.3	27.6	259.7	66.3
STYRENE	3	3	ND			
TOLUENE	3	1	545.0	40.7	1428.6	212.7
XYLENES	3	1	353.4	40.7	909.1	159.8

TABLE 20
(CONTINUED)

EXPOSURE RESULTS
BY JOB CATEGORY
FRONT-END LOADER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
NITROSAMINES	3	3	ND			
PCBs	4	4	ND			
PESTICIDES	3	3	ND			
PNA	3	3	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 21

EXPOSURE RESULTS
BY JOB CATEGORY
GUARD

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	7	7	ND			
ETHYL ACETATE	7	7	ND			
ISOPROPYL ACETATE	7	7	ND			
MIBK	7	7	ND			
N-PROPYL ACETATE	7	7	ND			
STYRENE	7	7	ND			
TOLUENE	7	7	ND			
XYLENES	7	7	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

TABLE 22

EXPOSURE RESULTS
BY JOB CATEGORY
INDUSTRIAL HYGIENIST

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	2	ND			
ETHYL ACETATE	2	2	ND			
ISOPROPYL ACETATE	2	2	ND			
MIBK	2	2	ND			
N-PROPYL ACETATE	2	2	ND			
STYRENE	2	2	ND			
TOLUENE	2	2	ND			
XYLENES	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

TABLE 23

EXPOSURE RESULTS
BY JOB CATEGORY
MARKING DRUMS

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	1	68.3	48.1	88.5	65.2
ETHYL ACETATE	2	0	269.3	96.1	442.5	206.3
ISOPROPYL ACETATE	2	1	112.5	48.1	177.0	92.2
MIBK	2	1	68.3	48.1	88.5	65.2
N-PROPYL ACETATE	2	2	ND			
STYRENE	2	1	201.0	48.1	354.0	130.5
TOLUENE	2	0	1065.8	96.1	2035.4	442.4
XYLENES	2	0	627.1	192.3	1061.9	451.9
OTHER SUBSTANCES						
PCBs	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

TABLE 24

EXPOSURE RESULTS
BY JOB CATEGORY
NIOSH TRAILER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	1	ND			
NITRATE	1	1	ND			
PHOSPHATE	1	0	23.1	23.1	23.1	.
SULFATE	1	1	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	2	ND			
ETHYL ACETATE	2	2	ND			
ISOPROPYL ACETATE	2	2	ND			
MIBK	2	2	ND			
N-PROPYL ACETATE	2	2	ND			
STYRENE	2	2	ND			
TOLUENE	2	2	ND			
XYLENES	2	2	ND			
OTHER SUBSTANCES						
NITROSAMINES	1	1	ND			
PCBs	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

TABLE 25

EXPOSURE RESULTS
BY JOB CATEGORY
LABORATORY TRAILER

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ELEMENTAL ANALYSES						
ALUMINUM	4	1	1.8	0.5	4.0	1.4
ANTIMONY	4	3	1.4	0.5	4.1	0.8
ARSENIC	4	3	1.2	0.5	3.2	0.8
CALCIUM	4	0	7.3	1.1	15.7	4.8
IRON	4	0	2.7	0.1	7.0	1.3
LEAD	4	3	1.0	0.5	2.6	0.8
MAGNESIUM	4	2	2.7	0.5	6.9	1.5
MANGANESE	4	4	ND			
MOLYBDENUM	4	30	0.7	0.5	1.2	0.6
PHORPHORUS	4	3	1.1	0.5	2.7	0.8
PLATINUM	4	3	0.9	0.5	2.1	0.7
SELENIUM	4	3	0.9	0.5	2.3	0.7
SODIUM	4	4	ND			
TELLURIUM	4	3	1.7	0.5	5.3	0.9
THALLIUM	4	3	0.8	0.5	1.7	0.7
TIN	4	2	1.1	0.5	2.3	0.9
TITANIUM	4	4	ND			
ZINC	4	3	1.1	0.5	2.9	0.8
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	4	4	ND			
ETHYL ACETATE	4	4	ND			
ISOPROPYL ACETATE	4	4	ND			
MIBK	4	4	ND			
N-PROPYL ACETATE	4	4	ND			
STYRENE	4	4	ND			
TOLUENE	4	2	86.1	42.4	169.5	72.7
XYLENES	4	3	87.0	42.4	177.0	72.7
OTHER SUBSTANCES						
NITROSAMINES	1	1	ND			
PCBs	2	2	ND			
PNAS	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

* Indicates a special analysis, not performed on the remainder of the samples of the same type.

TABLE 26

EXPOSURE RESULTS
BY JOB CATEGORY
SAMPLE CHEMIST

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ELEMENTAL ANALYSES						
ALUMINUM	2	0	12.5	6.4	18.5	10.9
ANTIMONY	2	2	ND			
ARSENIC	2	2	ND			
CALCIUM	2	0	40.5	36.4	44.6	40.3
IRON	2	0	10.8	6.6	15.1	10.0
LEAD	2	2	ND			
MAGNESIUM	2	0	9.1	8.5	9.6	9.0
MANGANESE	2	2	ND			
MOLYBDENUM	2	2	ND			
PHORPHORUS	2	2	ND			
PLATINUM	2	2	ND			
SELENIUM	2	2	ND			
SODIUM	2	2	ND			
TELLURIUM	2	2	ND			
THALLIUM	2	2	ND			
TIN	2	1	1.1	0.7	1.5	1.0
TITANIUM	2	2	ND			
ZINC	2	2	ND			
OTHER SUBSTANCES						
NITROSAMINES	2	2	ND			
PCBs	2	2	ND			
PESTICIDE	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

TABLE 27

EXPOSURE RESULTS
BY JOB CATEGORY
STAGING

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	2	2	ND			
CHLORIDE	2	0	40.5	31.0	50.0	39.4
NITRATE	2	2	ND			
PHOSPHATE	2	0	47.6	40.0	55.2	47.0
SULFATE	2	2	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	1	0	169.5	169.5	169.5	.
ETHYL ACETATE	1	0	423.7	423.7	423.7	.
ISOPROPYL ACETATE	1	1	ND			
MIBK	1	1	ND			
N-PROPYL ACETATE	1	0	169.5	169.5	169.5	.
STYRENE	1	0	678.0	678.0	678.0	.
TOLUENE	1	0	1101.7	1101.7	1101.7	.
XYLENES	1	0	1610.2	1610.2	1610.2	.
OTHER SUBSTANCES						
PNA	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 28

EXPOSURE RESULTS
BY JOB CATEGORY
TANKAGE/UTILITY WORKERS

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	2	2	ND			
CHLORIDE	2	1	9.8	5.1	14.5	8.6
NITRATE	2	2	ND			
PHOSPHATE	2	1	24.5	12.7	36.4	21.5
SULFATE	2	2	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	0	9.4	1.0	20.9	5.2
ANTIMONY	3	3	ND			
ARSENIC	3	3	ND			
CALCIUM	3	0	32.3	1.0	89.8	8.3
IRON	3	0	6.8	1.3	17.3	3.4
LEAD	3	3	ND			
MAGNESIUM	3	1	12.7	0.4	36.7	2.5
MANGANESE	3	2	1.3	0.4	3.0	0.8
MOLYBDENUM	3	3	ND			
PHORPHORUS	3	2	3.1	0.4	8.5	1.2
PLATINUM	3	3	ND			
SELENIUM	3	3	ND			
TELLURIUM	3	3	ND			
THALLIUM	3	3	ND			
TIN	3	1	3.0	0.4	6.2	1.9
TITANIUM	3	3	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	2	1	78.8	64.9	92.6	77.5
ETHYL ACETATE	2	1	125.1	64.9	185.2	109.7
ISOPROPYL ACETATE	2	2	ND			
MIBK	2	2	ND			
N-PROPYL ACETATE	2	1	78.8	64.9	92.6	77.5
STYRENE	2	1	125.1	64.9	185.2	109.7
TOLUENE	2	1	263.9	64.9	463.0	173.4
XYLENES	2	0	389.0	129.9	648.1	290.1

TABLE 28
(CONTINUED)

EXPOSURE RESULTS
BY JOB CATEGORY
TANKAGE/UTILITY WORKERS

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
NITROSAMINES	3	3	ND			
PESTICIDES	5	5	ND			
PCBs	4	4	ND			
PNAS	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.

4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

* Indicates a special analysis, not performed on the remainder of the samples of the same type.

TABLE 29

EXPOSURE RESULTS
BY JOB CATEGORY
WEATHER STATION

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
OTHER SUBSTANCES						
NITROSAMINES	1	1	ND			
PNA	1	1	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 30

GROUPED EXPOSURE RESULTS
SAMPLE CATEGORIES ASSIGNED TO EACH GROUP

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

GROUP	SAMPLE CATEGORY
CATEGORY 1 PERSONAL SAMPLES HI DEGREE OF EXPOSURE	DRUM FOREMEN DRUM HANDLERS DRUM SPOTTERS DRUM MARKERS SAMPLE CHEMISTS DRUM STAGING AND BULKING WORKERS UTILITY WORKERS
CATEGORY 2 PERSONAL AND AREA SAMPLES LOW DEGREE OF EXPOSURE	AIR TENDER DECON SHED DRIVER GUARDS WEATHER STATION WEATHER STATION
CATEGORY 3 HEAVY EQUIPMENT OPERATORS	BARREL GRABBER OPERATOR BOBCAT OPERATOR FRONT END LOADER OPERATOR BACKHOE OPERATOR
CATEGORY 4 AREA SAMPLES	AREA #1 AREA #2 AREA #3 AREA $3
CATEGORY 5 LABORATORY TRAILERS	CONTRACTOR LABORATORY TRAILER NIOSH LABORATORY

TABLE 31

GROUPED EXPOSURE RESULTS
AREA SAMPLES

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	1	ND			
NITRATE	1	1	ND			
PHOSPHATE	1	1	ND			
SULFATE	1	1	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	2	1.1	0.4	2.4	0.8
CALCIUM	3	0	10.2	4.6	19.9	8.3
IRON	3	0	3.4	0.8	6.8	2.4
MAGNESIUM	3	0	1.9	1.0	3.8	1.6
MANGANESE	3	3	ND			
PHORPHORUS	3	3	ND			
SODIUM	3	3	ND			
TIN	3	1	2.7	0.5	4.3	1.9
ZINC	3	3	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	6	6	ND			
ETHYL ACETATE	6	3	119.5	37.9	322.6	88.9
ISOPROPYL ACETATE	6	6	ND			
MIBK	6	6	ND			
N-PROPYL ACETATE	6	5	65.9	37.9	156.3	56.0
STYRENE	6	6	ND			
TOLUENE	6	4	233.6	37.9	887.1	112.5
XYLENES	6	3	152.1	37.9	312.5	101.7
OTHER SUBSTANCES						
NITROSAMINES	5	5	ND			
PCBs	5	5	ND			
PESTICIDES	9	9	ND			
PNAS	6	6	ND			

NOTE:
1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.
2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.
3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.
4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.
5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 32

GROUPED EXPOSURE RESULTS
HEAVY EQUIPMENT SAMPLES

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	4	4	ND			
CHLORIDE	4	1	22.0	3.1	32.7	16.2
NITRATE	4	4	ND			
PHOSPHATE	4	1	32.9	7.8	50.9	26.9
SULFATE	4	4	ND			
ELEMENTAL ANALYSES						
ALUMINUM	9	0	11.5	2.0	36.3	8.1
CALCIUM	9	0	30.3	5.4	99.8	19.8
IRON	9	0	11.2	4.2	26.3	9.1
MAGNESIUM	9	0	7.5	1.3	25.3	4.7
MANGANESE	9	8	0.6	0.4	2.1	0.5
PHORPHORUS	9	2	1.3	0.4	2.3	1.1
SODIUM	9	8	0.7	0.4	2.7	0.5
TIN	9	3	2.0	0.4	4.2	1.4
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	12	8	83.4	27.6	370.4	63.8
ETHYL ACETATE	12	5	278.4	36.5	1562.5	134.4
ISOPROPYL ACETATE	12	10	64.0	27.6	156.3	56.8
MIBK	12	12	ND			
N-PROPYL ACETATE	12	8	95.3	27.6	259.7	75.8
STYRENE	12	10	99.8	27.6	438.0	68.2
TOLUENE	12	3	656.2	38.5	2265.6	326.2
XYLENES	12	4	576.9	38.5	3046.9	251.0
ZINC	9	8	0.6	0.4	2.1	0.5
OTHER SUBSTANCES						
NITROSAMINES	11	11	ND			
PCBs	13	13	ND			
PESTICIDES	12	12	ND			
PNAS	10	10	ND			

NOTE:
1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.
2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.
3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.
4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.
5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 33

GROUPED EXPOSURE RESULTS
MOBILE LABORATORIES

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	1	1	ND			
CHLORIDE	1	1	ND			
NITRATE	1	1	ND			
PHOSPHATE	1	0	23.1	23.1	23.1	
SULFATE	1	1	ND			
ELEMENTAL ANALYSES						
ALUMINUM	4	1	1.8	0.5	4.0	1.4
CALCIUM	4	0	7.3	1.1	15.7	4.8
IRON	4	0	2.7	0.1	7.0	1.3
MAGNESIUM	4	2	2.7	0.5	6.9	1.5
MANGANESE	4	4	ND			
PHORPHORUS	4	3	1.1	0.5	2.7	0.8
SODIUM	4	4	ND			
TIN	4	2	1.1	0.5	2.3	0.9
ZINC	4	3	1.1	0.5	2.9	0.8
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	6	6	ND			
ETHYL ACETATE	6	6	ND			
ISOPROPYL ACETATE	6	6	ND			
MIBK	6	6	ND			
N-PROPYL ACETATE	6	6	ND			
STYRENE	6	6	ND			
TOLUENE	6	4	71.3	39.7	169.5	60.4
XYLENES	6	5	71.9	39.7	177.0	60.4
OTHER SUBSTANCES						
NITROSAMINES	2	2	ND			
PCBs	3	3	ND			
PNAS	2	2	ND			

NOTE: 1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.

2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.

3. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.

4. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 34

GROUPED EXPOSURE RESULTS
PERSONAL SAMPLES-HIGH EXPOSURE GROUP

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	4	4	ND			
CHLORIDE	4	1	25.2	5.1	50.0	18.4
NITRATE	4	4	ND			
PHOSPHATE	4	1	36.1	12.7	55.2	31.8
SULFATE	4	4	ND			
ELEMENTAL ANALYSES						
ALUMINUM	5	0	10.6	1.0	20.9	7.0
CALCIUM	5	0	35.6	1.0	89.8	15.6
IRON	5	0	8.4	1.3	17.3	5.3
MAGNESIUM	5	1	11.2	0.4	36.7	4.2
MANGANESE	5	4	1.0	0.4	3.0	0.7
PHORPHORUS	5	4	2.1	0.4	8.5	0.9
SODIUM	5	5	ND			
TIN	5	2	2.3	0.4	6.2	1.5
ZINC	5	5	ND			
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	8	4	114.4	48.1	188.7	103.2
ETHYL ACETATE	8	3	219.9	64.9	442.5	177.0
ISOPROPYL ACETATE	8	7	86.1	42.4	177.0	72.9
MIBK	8	7	75.1	42.4	172.4	66.9
N-PROPYL ACETATE	8	5	108.9	44.2	188.7	94.6
STYRENE	8	4	234.6	48.1	678.0	167.4
TOLUENE	8	2	693.4	64.9	2035.4	376.4
XYLENES	8	1	604.1	90.9	1610.2	400.0
OTHER SUBSTANCES						
NITROSAMINES	5	5	ND			
PCBs	9	9	ND			
PESTICIDES	8	9	ND			
PNAS	3	3	ND			

NOTE:
1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.
2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.
3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.
4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.
5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

TABLE 35

GROUPED EXPOSURE RESULTS
PERSONAL SAMPLES-LOW EXPOSURE GROUP

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m^3	MINIMUM VALUE ug/m^3	MAXIMUM VALUE ug/m^3	GEOMETRIC MEAN ug/m^3
ACID ANIONS						
BROMIDE	4	4	ND			
CHLORIDE	4	2	6.6	3.3	9.9	5.7
NITRATE	4	4	ND			
PHOSPHATE	4	2	14.0	8.3	19.8	12.8
SULFATE	4	4	ND			
ELEMENTAL ANALYSES						
ALUMINUM	3	0	8.1	4.9	12.8	7.4
CALCIUM	3	0	25.3	15.5	38.0	23.6
IRON	3	0	10.8	3.9	22.2	8.2
MAGNESIUM	3	1	5.0	1.0	9.6	3.5
MANGANESE	3	3	ND			
PHORPHORUS	3	2	1.2	0.6	2.2	1.1
SODIUM	3	3	ND			
TIN	3	1	2.7	1.0	5.3	2.1
ZINC	3	2	1.2	0.6	2.2	1.1
VOLATILE ORGANIC VAPORS						
1,2-DICHLOROETHANE	13	13	ND			
ETHYL ACETATE	13	13	ND			
ISOPROPYL ACETATE	13E	13	ND			
MIBK	13	13	ND			
N-PROPYL ACETATE	13	13	ND			
STYRENE	13	13	ND			
TOLUENE	13	11	101.3	16.3	283.0	79.7
XYLENES	13	13	ND			
OTHER SUBSTANCES						
NITROSAMINES	4	4	ND			
PCBs	1	1				
PESTICIDES	2	2	ND			
PNAS	2	2	ND			

NOTE:
1. A value equal to one-half of the limit of detection divided by the mean daily sample volume for the substance was used in calculating the arithmetic and geometric means when the laboratory results were below the analytical limit of detection.
2. The following elemental analysis were accomplished, but the analytes were less then the detection limit of 1.0 ug/filter: Ag, Ba, Be, Cd, Co, La, Li, Sr, V, Y, Zr.
3. The following pesticides were quantitated, but the analytes were less then the detection limit: Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Lindane.
4. The following PCBs were quantitated, but the analytes were less then the detection limit: AROCLOR 1016, AROCLOR 1211, AROCLOR 1232, AROCLOR 1242, AROCLOR 1248, AROCLOR 1254, AROCLOR 1260.
5. The following PNAs were quantitated, but the analytes were less then the detection limit: Fluoranthene, Pyrene, B(A)A, Chrysene, B(E)P, B(A)P.

APPENDIX I

SAMPLING AND ANALYSIS METHODOLOGY

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

Analyte	Collection Device	Flow Rate (1pm)	Duration (Hr)	Analytic Method	LOD
ACID ANIONS	Silica Gel	0.5	4-8	IC	*1
ELEMENTAL ANALYSIS	Mixed Cellulose Polyester Filter	1.75	4-8	ICP/AES	1ug
NITROSAMINES	Thermosorb/N	0.5	4-8	GC/TEA	50ng
ORGANIC VAPORS	Charcoal Tube	0.2	4-8	GC/mS	10ug
PCBs	Florisil	0.2	4-8	GC/ECD	*2
PESTICIDES	GF Filter	0.2	4-8	GC/EC	*3
PNAs	Teflon Filter	0.5	4-8	HPLC	*4

NOTE: 1. IC means ion chromatography. ICP/AES means inductively coupled plasma atomic emission spectrometry. GC/mS means gas chromatography/mass spectrometry. GC/FID means gas chromatography/flame ionization detection. HPLC means high performance liquid chromatography. GC/EC means gas chromatography with an electron capture detector. CG/ECD means gas chromatography with an electrolytic conductivity detector. GC/TEA means gas chromatography with a Thermo Energy Analyzer detector.

*1. The estimated limit of detection was 4 ug/sample for chloride, bromide, and nitrate; 10 ug/sample for pohosphate and sulfate.

*2. The limit of detection was 0.05 ug/sample for Aroclors 1016, 1242, 1248, 1254, and 1260; 0.1 ug/sample for Aroclors 1221 and 1232.

*3. The limit of detection was 0.002 ug/sample for aldrin, dieldrin, heptachlor, and lindane; 0.005 ug/sample for chlordane.

*4. The limit of detection was 50 ng/sample for Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(e)pyrene, and Benzo(a)pyrene.

APPENDIX II

EVALUATION CRITERIA FOR DETECTED SUBSTANCES

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHEM-DYNE HAZARDOUS WASTE SITE
HAMILTON, OHIO
JUNE 7-10, 1983

	ACGIH	OSHA	NIOSH
All criteria are expressed as 8-hr TWAs in units of ug/m^3, except as noted			
VOLATILE ORGANIC COMPOUNDS			
1,2-DICHLOROETHANE	350,000	400,000	
ETHYL ACETATE	1,400,000	1,400,000	
ISOPROPYL ACETATE	950,000	950,000	
MIBK	205,000	410,000	200,000
N-PROPYL ACETATE	840,000	840,000	
STYRENE	215,000	430,000	
TOLUENE	375,000	750,000	375,000
XYLENE	435,000	435,000	435,000
PARTICULATE SPECIES			
ANTIMONY	500	500	500
ARSENIC (Inorganic)	100	10	2
LEAD (Inorganic)	150	50	50

NOTE: 1. There are no occupational health standards for chloride and phosphate anions or for aluminum, calcium, iron, magnesium, manganese, phosphorus, sodium, tin, or zinc; unless the specific compound can be identified.

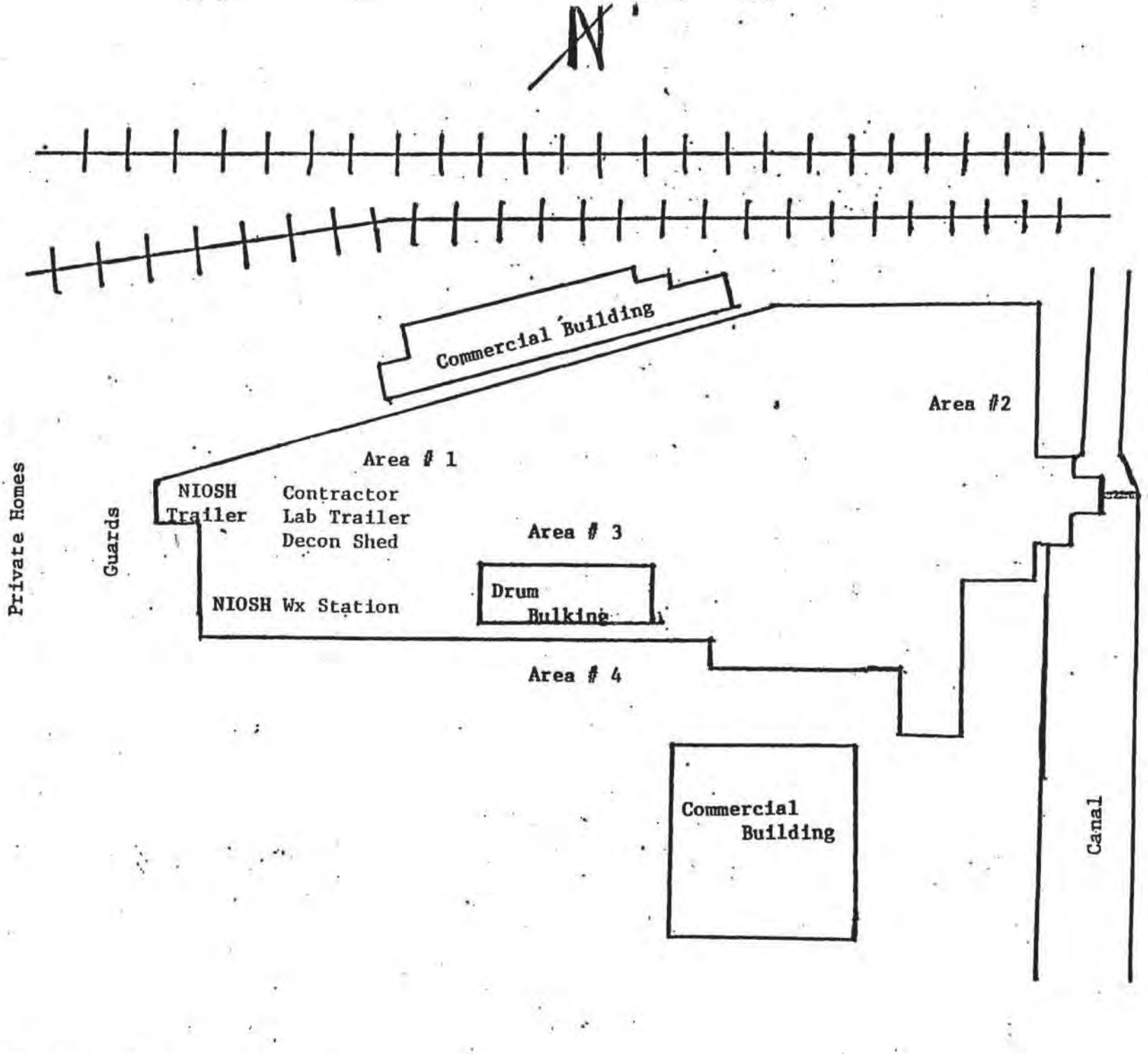

FIGURE 1. Chem-Dyne Site Plan (not to scale)

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