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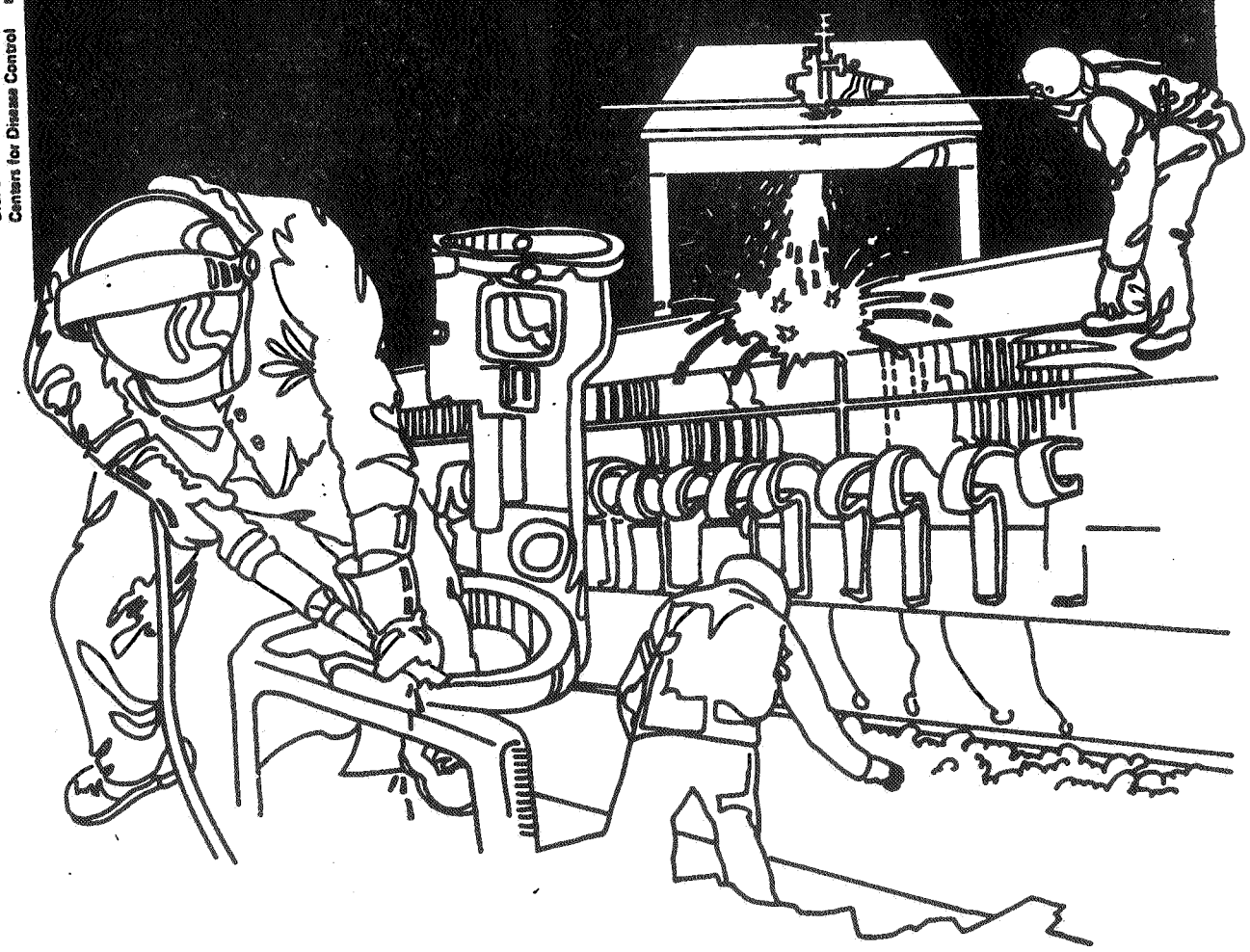

Health Hazard Evaluation Report

HETA 82-305-1541
FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

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 82-305-1541
DECEMBER 1984
FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

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I. SUMMARY

In response to a June 1982 request for technical assistance from the Commissioner of Health for the City of New York, the National Institute for Occupational Safety and Health (NIOSH) conducted air monitoring to measure occupational exposures to chemicals at the Fountain Avenue Landfill, Brooklyn, New York. The Fountain Avenue Landfill is a 297 acre site, which began operation in the early 1960s. It receives about 8200 tons (44%) of the 21000 tons of refuse generated by New York City each day.

An air monitoring study was conducted September 26-28, 1982 and a followup study of noise and carbon monoxide exposure was conducted on September 17, 1983. In September 1982, NIOSH collected 210 samples: 55 samples for organic vapors, 49 samples for elemental analysis, 38 samples for total dust exposure, 26 samples for PNAs, 22 samples for pesticides, 14 samples for asbestos, and 6 samples for crystalline silica. Of the 210 samples 52 were personal samples and the remainder were area samples placed as close as possible to the breathing zone of heavy equipment operators and scale clerks.

Organic vapors, metals, asbestos, quartz and airborne dusts were detected. The arithmetic mean benzene concentration in air measured in 55 samples was 71 ug/m^3 (maximum 499 ug/m^3). Perchlorethylene was measured at an arithmetic mean concentration of 386 ug/m^3 (maximum 7107 ug/m^3), toluene at 269 ug/m^3 (maximum 2144 ug/m^3) and xylene at 229 ug/m^3 (maximum 2980 ug/m^3). Metals were detected in 49 air samples at very low levels. The metals measured included lead (arithmetic mean: 2.2 ug/m^3, maximum 21 ug/m^3), zinc (arithmetic mean: 8.6 ug/m^3, maximum 340 ug/m^3), and iron (arithmetic mean: 24.4 ug/m^3, maximum 481 ug/m^3). Asbestos was detected in 2 of 14 samples at concentrations of 0.01 fibers per cubic centimeter. Quartz was detected in 3 of 6 samples at an arithmetic mean concentration of 9 ug/m^3. The arithmetic mean weight of total dust in 38 samples was 255 ug/m^3 (maximum 2753 ug/m^3). PNAs and pesticides were not detected in any sample. Fixed location grab samples for cyanides, phenols, hydrocarbons, and formaldehyde collected in 1982 were all below the limit of detection. Full shift samples for carbon monoxide collected on heavy equipment operators during 1983 were all below the limit of detection (6.8 ppm). All air sample concentrations were below recognized occupational health standards.

The mean mass median aerodynamic particle diameters in the 11 samples was 8.3 microns and the standard deviation was 3.4. Using a plot, on log-probability paper, of a distribution with a geometric mean of 8.3 and a geometric standard deviation of 3.4, it was estimated that approximately 55% of the airborne dust particles were respirable, that is between 1 and 10 microns in size.

Noise exposure was measured on vehicle operators during operation of heavy equipment. The A-weighted noise exposure for all 11 samples varied between 82.9 and 95.5 dB and the maximum one hour exposure recorded was 100.7 dB. Three of the exposures were slightly above regulatory standards, if hearing protection had not been worn.

No overexposure to chemicals was observed during this study. Hazardous noise exposure was adequately controlled by use of hearing protection and implementation of a hearing conservation program.

KEYWORDS: SIC 4953 (Refuse Systems) Landfills, air sampling, hazardous noise, asbestos, solvents, metals.

II. BACKGROUND

In response to a June 1982 request for technical assistance from the Commissioner of Health for the City of New York, the National Institute for Occupational Safety and Health (NIOSH) conducted air monitoring to measure occupational exposures to chemicals at the Fountain Avenue Landfill, Brooklyn, New York. Management concerns were both the health and safety of the workers on-site and the possible migration of contaminants from the landfill to nearby housing areas. Although NIOSH does not conduct community health studies, it was hypothesized that acceptable occupational exposures to airborne contaminants on the site would imply a minimal risk by the air route to nearby residents. A planning meeting was held with Health and Sanitation Department personnel July 7, 1982 and initial sampling was conducted between October 26 and October 28, 1982. A followup study was conducted September 17, 1983. Interim results were furnished to interested representatives of management and labor November 6, 1983.

The Fountain Avenue Landfill is a 297 acre site, which began operation in the early 1960s. It is located in Brooklyn, New York, South of the Belt Parkway and west of Fountain Avenue. The landfill extends approximately 3500 feet into Jamica Bay and receives about 8200 tons (44%) of the 21000 tons of refuse generated by New York City each day.[1]

III. METHODS

A. Literature Search

A literature search for information concerning landfill employee exposure to toxic chemicals produced negative results. A number of current and historical references treat the composition of landfill gas[3] the exposures of workers at chemical disposal sites[4,5], and the exposures of workers engaged in environmental mitigation activities.[3] However, no published accounts of worker exposure to conditions similar to Fountain Avenue Landfill were located.

B. Review of Previous Studies

There has been no previous air monitoring at the Fountain Avenue Landfill.[1] A 1982 study[2] reported that mercury in surface waters collected at the site exceeded the New York State drinking water standard and cadmium, lead, mercury, and phenols had been measured at levels in excess of the New York State ground water standards for drinking water. Testimony before the New York Senate Select Committee on Crime indicated that waste oil, sludges, metal plating waste, and solvents had been disposed at the Fountain Avenue Landfill between 1974 and 1980. Elevated groundwater cyanide concentrations had been detected in nearby wells in 1980, but this result could not be duplicated in 1982.[1]

C. Process Description

Trucks transporting waste for disposal were weighed and assessed fees at three entry stations managed by scale clerks. At the face of the various active fill cells, attendants supervised the unloading of the waste collection trucks and insured vehicle safety during operations near the fill face. Heavy equipment operators moved temporary and permanent cover material over waste and constructed temporary roads on-site. Mechanics cleaned and maintained the heavy equipment at the end of each shift. Utility workers performed a variety of tasks on an intermittent basis including operating a heavy equipment and water carts for dust and fire supression. Engineers, surveys, and supervisors provided design plans, management resources, and documentation of fill development.

D. Study Strategy

The strategy used in this study was to monitor operational personnel for these substances for potential airborne contaminats at the Fountain Avenue site. The substances were selected based on consideration of the unit operations. The classes of compounds selected included asbestos, which was known to be landfilled at this site; volatile organic vapors, heavy metals, pesticides, and polynuclear aromatics (PNAs) which could be released from materials disposed at the site and (at are low level components of vehicle exhaust emissions); crystalline silica and total dust, derived from handling of cover soils; low molecular weight hydrocarbons and hydrogen sulfide from degredation of fill materials; and the major vehicle exhaust emissions carbon monoxide, oxides of nitrogen, and sulfur dioxide.

Scale Clerks were potentially exposed to vehicle exhaust emissions and to any volatile or particulate materials escaping from the collection vehicles. Attendants and heavy equipment operators were potentially exposed to the gases generated by the landfill, emissions from the refuse deposited, the crystalline silica in the fill cover material, and exhausts from the heavy equipment.

Before testing for significant differences in exposure between days and jobs, the distribution of sample results was determined for each of the 30 substances. The concentration results for six substances (dichlorobenzene, limonene, trichloroethane, quartz, total other hydrocarbons, and total weight) were best represented by a log-normal distribution and tests for differences between days and jobs were made using analysis of variance of the log transformed values. Three substances were not detected in any sample. Results for all other 21 substances were neither normally nor log-normally distributed and tests for differences between days and jobs were made using non-parametric statictics.

E. Weather

Weather was cloudy during the morning of October 26, 1982 and sunny and mild throughtout remainder of the study. Reported temperatures for New York City varied between 45-57°F during October 26th, 46-63°F during October 27th, and 44-67°F during October 28th. Winds were generally less than 15 knots during the study. An Atlantic storm had passed through the area the day preceeding the study (October 25th). Nearly an inch of rain fell, winds had reached 40 miles per hour and temperature had ranged between 43-46°F. Total annual precipitation for New York City on October 28, 1982 was 36.49 inches, 3.5 inches above the annual norm.

F. Air Sampling Protocol

The sample collection media used in this study are summarized in Appendix I. Battery operated personal sampling pumps, which drew air from the breathing zone, (the portion of the body roughly defined by the nose and the collar bone) through various collection media were attached to individual workers. These included attendants, mechanics, engineers, surveyors, officers, office workers, and utility men. Fixed location area samples were collected near the breathing zone of heavy equipment operators and scale operators. Since the fixed location samples were not attached to workers, a battery of several samplers were operated at the same location.

NIOSH collected 210 samples: 55 samples for organic vapors, 49 samples for elemental analysis, 38 samples for total dust exposure, 26 samples for PNAs, 22 samples for pesticides, 14 samples for asbestos, and 6 samples for crystalline silica. Of the 210 samples 52 were personal samples and the remainder were area samples placed as close as possible to the breathing zone of heavy equipment operators and scale clerks.

G. Noise

Noise exposure was monitored using a Metrosonics db-301/651 dosimeter system. The recording dosimeter measures A-weighted sound levels in decibels. the instrument has a baseline of 60 dB, a dynamic range of 64 dB and a sample rate of 4 per second.[3] The device reports the OSHA average level, which is the constant sound level, in a given situation and time period, that conveys the same OSHA equivalent dose as does an actual time-varying sound during the same time period. In accordance with OSHA procedure, a 5dB amplitude increment is weighted as a doubling of amplitude of exposure.[4] The dosimeter reader provides both a time history of exposure and cumulative and hourly exposure measurements.

H. 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). The balance of the samples were analyzed for the major contaminants detected in the 8 samples analyzed by GC/MS.

All samples analyzed for elemental analysis were screened 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.

PNAs Phenanthrene, anthracene, fluoranthene, pyrene, benzo(a) anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benze(a)pyrene, indeno(1,2,3,c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,i,h)perylene were analyzed in all filters and sorbents collected for PNA analysis.

The filters and sorbents collected for pesticide analysis were qualitatively screened for organophosphate and organochlorine pesticides.

For particle size analysis, dust was collected on the stainless steel stages and PVC filter of a 5-stage cascade impactor powered by a personal sampling pump. Following equilibration, the total weight gain on each stage was determined by reweighing them with a balance.

Analysis for asbestos, silica, and total weight are described in Appendix I.

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). These evaluation criteria are presented in Appendices II-IV

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.

V. RESULTS

A. Air Samples

The results of the air samples sorted by day are presented in Tables 1 to 4. The results of the air samples sorted by job category are presented in Tables 5 to 18. Descriptive statistics, such as the number of observations, arithmetic mean, maximum and minimum value and geometric means are also given.

The arithmetic mean benzene in air concentration measured in 55 samples was 71 ug/m^3 (maximum 499 ug/m^3). Perchlorethylene was measured at an arithmetic mean concentration of 386 ug/m^3 (maximum 7100 ug/m^3), toluene at 269 ug/m^3 (maximum 2140 ug/m^3) and xylene at 229 ug/m^3 (maximum 2980 ug/m^3).

Metals were detected in 49 air samples at very low levels. The metals measured included lead (arithmetic mean: 2.2 ug/m^3, maximum 21 ug/m^3), zinc (arithmetic mean: 8.6 ug/m^3, maximum 340 ug/m^3), and iron (arithmetic mean: 24.4 ug/m^3, maximum 481 ug/m^3).

Asbestos was detected in 2 of 14 samples. The concentration of asbestos in each of the 2 samples was 0.01 fibers per cubic centimeter. Quartz was detected in 3 of 6 samples at an arithmeic mean concentration of 9 ug/m^3. The arithmetic mean weight of total dust in 38 samples was 255 ug/m^3 (maximum 2750 ug/m^3). PNAs and pesticides were not detected in any sample.

The airborne contaminant concentrations did not increase systematically between the sampling days. Thus, it does not appear that the heavy rains that immediately preceeded the study influenced the results.

The concentration of 5 substances (calcium, lead, magnesium, toluene, and xylene) increased between the first sampling day (September 26th) and last sampling day (September 28). The concentration of zinc was highest on the first sampling day and lowest on the last day. The concentration of total other hydrocarbons was highest on the last sampling day. There were no statistically significant differences between the concentrations measured on the three sampling days for the other 23 substances.

There were statistically significant differences between jobs for 6 substances (dichlorobenzene, limonene, trichloroethane, total other hydrocarbons, toluene, and xylene). Mechanics had the highest mean exposures to toluene (arithmetic mean: 1084 ug/m^3), xylene (arithmetic mean: 1310 ug/m^3), and total other hydrocarbons (geometric mean: 9803 ug/m^3). Utility workers had the highest exposure to dichlorobenzene (geometric mean: 149 ug/m^3) and garbage face workers had the highest mean exposure to trichloroethane (geometric mean: 310 ug/m^3) and limonene (geometric mean: 582 ug/m^3).

Mechanics were exposed to significantly more chemicals and in higher concentrations that the other job groups. This may reflect work indoors, in the immediate vicinity of vehicle exhaust, and close contact of these workers with contaminants adhering to these vehicles.

B. Particle Size Distributions

The cumulative weight increase for each stage of the miniature cascade impactors was calculated and the results plotted on log-probability paper. The mass median aerodynamic diameter and its standard deviation were determined for each sample. The mean mass median aerodynamic particle diameters in the 11 samples was 8.3 microns and the standard deviation was 3.4. Using a plot, on log-probability paper, of a distribution with a geometric means of 8.3 and a geometric standard deviation of 3.4, it was estimated that approximately 55% of the airborne dust particles were respirable, that is between 1 and 10 microns in size.

C. Direct Reading Instruments

Air was aspirated through direct reading indicator tubes for detection of light hydrocarbons (methane, ethane, etc.), total cyanides, phenols, and formaldehyde on October 26, 1982. The first three compounds were measured in the parking lot south of the engineers trailer, the active bank, and easy pack. Formaldehyde was measured inside the engineers trailer and on the active bank and easy pack. No hydrocarbons, cyanides, or phenols were detected. The limits of detection given by the manufacturer for these tests were: Methane - 5000 ppm, propane and ethane - 50 ppm; total cyanides - 7 ppm; and phenol - 5 ppm. A trace of formaldehyde was detected inside the engineers trailer. No formaldehyde was detected at the active bank or easy pack. The manufacturer's reported limit of detection for formaldehyde was 0.5 ppm.

Twelve batteries of 4 long term detector tubes were placed near the breathing zone of the scale operator and on 12 pieces of heavy equipment on September 26 and 27th. Carbon monoxide was not detected at a manufacturer's reported limit of detection of 6.3 ppm. Oxides of nitrogen were not detected (limit of detection: 13 ppm). Sulfur dioxide was not detected (limit of detection: 1.3 ppm). Hydrogen sulfide was not detected (limit of detection 0.63 ppm).

Six long term carbon monoxide indicator tubes were attached to heavy equipment operators during the visit of September 17, 1983. No carbon monoxide was detected. The manufacturer's reported limit of detection for carbon monoxide was 6.3 ppm.

D. Noise

Eleven dosimeter readings of 2 to 6 hours duration were made on heavy equipment operations on September 17, 1983 (Table 19). Eight of the 11 noise dosimeter measurements exceeded 6 hours in duration. The A-weighted noise exposure for all 11 samples varied between 82.9 and 95.5 dB and the maximum one hour exposure recorded was 100.7 dB. Three of the exposures were slightly above regulatory standards, if hearing protection had not been worn. However, hearing protection was available to all heavy equipment operators and this procedure would adequately reduce noise exposure. Operators reported that they were receiving monitoring audiometry. A hearing conservation program is required for workers exposed to the levels of noise measured during this survey.

VI. CONCLUSIONS

1. No chemical exposure to any occupational group at the Fountain Avenue Landfill exceeded a recognized occupational exposure standard and most exposures were less than 1/100 to 1/1000th of the applicable standards.

2. Noise from the operation of heavy equipment is the only hazard demonstrated by this study and hazardous noise exposure was adequately controlled at the time of this study by use of hearing protection and the implementation of a hearing conservation program.

VII. RECOMMENDATIONS

Other than noise, for which a hearing conservation program (including audiometry) is already in place, this study did not identify any occupational exposures that would warrant medical monitoring of workers. There are no data indicating that sanitary landfill workers are more at risk than other workers of any preventable infectious disease. Like everyone else, landfill workers should have a current tetanus immunization (a booster every ten years following a complete childhood or adult primary series). Vehicle drivers and equipment operators should of course, have whatever physical examinations are required for licensing. Finally, the lack of need for specific medical monitoring should not be interpreted as diminishing the appropriateness of other occupational or general health services provided to employees.

VIII. REFERENCES

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6. Metrosonics, Inc., Box 10890, Rochester, NY 14618: Instruction Manual for db-301/651 Metrologging System.

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IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report have been sent to:

1. Commissioner of Health, The City of New York, 125 Worth Street, New York, NY 10013
2. Commissioner of Sanitation, The City of New York, 125 Worth Street, New York, NY 10013
3. Municipal Tractor Operators' Association, Box 243, Rosebank, Staten Island, NY 10305
4. Uniformed Sanitationmen's Association, Local 831, 25 Cliff Street, New York, NY 10038
5. District Council 37, American Federation of State, County, and Municipal Employees, 140 Park Place, New York, NY 10007
6. International Union of Operating Engineers, 265 West 14th Street, New York, NY 10011
7. NIOSH Region II
8. OSHA Region II

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

EXPOSURE RESULTS
BY DAY

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	49	11	9.7	0.6	257.7	2.6
ASBESTOS	14	12	0.0	0.0	0.0	0.0
BARIUM	49	47	1.1	0.5	12.2	0.9
BENZENE	55	40	70.8	9.7	449.3	50.3
CALCIUM	49	0	43.8	4.2	1099.2	17.4
CHRISTABOLITE	6	6				
CHROMIUM	49	44	0.9	0.5	1.8	0.9
COPPER	49	45	1.0	0.5	4.6	0.9
DICHLOROBENZENE	24	14	63.7	9.6	183.5	43.5
ETHYL ACETATE	24	20	69.2	9.6	502.3	33.2
IRON	49	2	24.4	1.2	480.7	9.9
LEAD	49	22	2.2	0.6	21.0	1.6
LIMONENE	24	8	199.9	9.6	1750.0	69.2
MIBK	24	23	35.6	9.6	178.6	23.0
MAGNESIUM	49	10	6.6	1.1	142.9	3.2
NICKEL	49	48	1.0	0.5	6.0	0.8
PERCHLOROETHYLENE	55	27	386.4	11.2	7107.1	95.1
PESTICIDES	22	22				
PNAS	26	26				
QUARTZ	6	3	9.0	3.7	24.7	7.1
SODIUM	49	44	1.1	0.5	4.9	0.8
TITANIUM	49	44	1.2	0.5	12.2	0.9
TOLUENE	55	25	269.1	13.7	2143.8	118.4
TOTAL OTHER HYDROCARBONS	55	16	1911.6	87.7	17813.5	622.2
TOTAL WEIGHT	38	1	255.3	7.8	2751.8	149.4
TRICHLOROETHANE	24	11	187.0	9.7	1535.7	52.4
XYLENE	55	28	228.7	13.7	2979.8	98.2
ZINC	49	39	8.6	0.5	340.3	1.3
N-BUTYL ACETATE	24	20	68.7	9.7	756.8	29.8
N-HEXANE	55	45	128.6	9.6	1550.7	54.6

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 2

EXPOSURE RESULTS
BY DAY

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26, 1982

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
ALUMINUM	15	5	19.8	0.6	257.7	3.0
ASBESTOS	3	3	0.0	0.0	0.0	0.0
BARIUM	15	14	1.6	0.6	12.2	1.0
BENZENE	19	14	79.5	9.7	292.8	57.3
CALCIUM	15	0	83.9	4.2	1099.2	13.9
CHRISTOBALITE	2	2				
CHROMIUM	15	13	1.0	0.6	1.8	0.9
COPPER	15	14	1.1	0.6	4.6	0.9
DICHLOROBENZENE	5	3	65.4	9.7	127.1	40.2
ETHYL ACETATE	5	4	35.5	9.7	86.8	23.4
IRON	15	1	38.8	1.3	480.7	7.7
LEAD	15	12	2.3	0.6	21.0	1.1
LIMONENE	5	2	81.9	12.4	306.8	37.2
MIBK	5	5	20.8	9.7	56.8	16.0
MAGNESIUM	15	5	11.6	1.1	142.9	2.7
NICKEL	15	15	0.9	0.6	1.4	0.8
PERCHLOROETHYLENE	19	11	146.1	24.3	1534.1	71.6
PESTICIDES	4	4				
PNAS	8	8				
QUARTZ	2	1	6.6	4.6	8.6	6.3
SODIUM	15	15	0.9	0.6	1.4	0.8
TITANIUM	15	13	1.7	0.6	12.2	1.1
TOLUENE	19	11	167.3	13.7	1049.6	83.0
TOTAL OTHER HYDROCARBONS	19	11	1495.7	87.7	10287.8	324.8
TOTAL WEIGHT	12	1	157.5	7.8	352.9	101.2
TRICHLOROETHANE	5	2	88.2	9.7	186.1	54.8
XYLENE	19	12	160.8	13.7	1166.3	78.6
ZINC	15	9	25.1	0.6	340.3	2.3
N-BUTYL ACETATE	5	5	20.8	9.7	56.8	16.0
N-HEXANE	19	17	101.3	9.7	670.0	50.9

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 3

EXPOSURE RESULTS
BY DAY

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 27, 1982

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
ALUMINUM	18	3	4.1	1.0	10.3	3.4
ASBESTOS	6	5	0.0	0.0	0.0	0.0
BARIUM	18	18	0.9	0.5	1.6	0.8
BENZENE	20	15	70.9	11.1	449.3	46.7
CALCIUM	18	0	18.3	4.9	57.1	15.9
CHRISTOBALITE	2	2				
CHROMIUM	18	18	0.9	0.5	1.6	0.8
COPPER	18	18	0.9	0.5	1.6	0.8
DICHLOROBENZENE	8	2	55.0	9.6	129.8	41.8
ETHYL ACETATE	8	7	33.0	9.6	120.0	19.7
IRON	18	1	11.2	1.2	38.1	8.9
LEAD	18	7	1.5	1.0	2.9	1.5
LIMONENE	8	3	93.1	9.6	340.0	42.8
MIBK	8	7	29.4	9.6	91.1	19.1
MAGNESIUM	18	3	3.3	1.1	6.8	2.9
NICKEL	18	17	1.1	0.5	6.0	0.9
PERCHLOROETHYLENE	20	10	202.2	23.3	1484.4	96.2
PESTICIDES	10	10				
PNAS	10	10				
QUARTZ	2	1	14.2	3.7	24.7	9.6
SODIUM	18	15	1.4	0.5	4.9	1.0
TITANIUM	18	16	0.9	0.5	1.6	0.9
TOLUENE	20	11	135.7	40.0	797.1	88.7
TOTAL OTHER HYDROCARBONS	20	5	1032.5	109.9	8072.5	549.1
TOTAL WEIGHT	14	0	359.7	17.3	2752.8	166.5
TRICHLOROETHANE	8	4	68.4	9.7	376.8	28.2
XYLENE	20	12	104.9	37.8	753.6	73.1
ZINC	18	15	1.6	0.6	10.3	1.1
N-BUTYL ACETATE	8	6	32.6	9.7	101.9	21.7
N-HEXANE	20	18	126.1	9.6	1550.7	46.5

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 4

EXPOSURE RESULTS
BY DAY

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 28, 1982

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
ALUMINUM	16	3	6.4	1.2	36.0	4.3
ASBESTOS	5	4	0.0	0.0	0.0	0.0
BARIUM	16	15	0.9	0.5	1.9	0.8
BENZENE	16	11	60.4	10.2	178.6	47.4
CALCIUM	16	0	35.0	6.1	182.8	23.8
CHRISTOBALITE	2	2				
CHROMIUM	16	13	1.0	0.5	1.5	0.9
COPPER	16	13	1.0	0.5	1.5	0.9
DICHLOROBENZENE	11	9	69.3	10.2	183.5	46.5
ETHYL ACETATE	11	9	110.8	10.2	502.3	56.8
IRON	16	0	25.8	3.4	123.8	14.2
LEAD	16	3	2.8	1.2	7.9	2.5
LIMONENE	11	3	331.1	15.3	1750.0	130.1
MIBK	11	11	46.9	10.2	178.6	30.9
MAGNESIUM	16	2	5.7	1.2	30.8	4.1
NICKEL	16	16	0.8	0.5	1.5	0.8
PERCHLOROETHYLENE	16	6	901.8	11.2	7107.1	131.2
PESTICIDES	8	8				
PNAS	8	8				
QUARTZ	2	1	6.2	4.3	8.1	5.9
SODIUM	16	14	1.1	0.5	3.4	0.9
TITANIUM	16	15	1.0	0.5	2.5	0.9
TOLUENE	16	3	556.7	46.7	2143.8	259.4
TOTAL OTHER HYDROCARBONS	16	0	3504.3	205.6	17813.5	1573.8
TOTAL WEIGHT	12	0	231.3	87.8	471.9	194.3
TRICHLOROETHANE	11	5	318.1	10.2	1535.7	80.4
XYLENE	16	4	464.1	46.7	2979.8	184.9
ZINC	16	15	1.1	0.5	4.4	0.9
N-BUTYL ACETATE	11	9	116.7	10.2	756.8	49.7
N-HEXANE	16	10	164.1	12.8	1188.8	72.6

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 5

EXPOSURE RESULTS
BY JOB CATEGORY
ASBESTOS BURIAL AREA

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	3	1	2.7	1.1	4.3	2.4
ASBESTOS	3	3	0.0	0.0	0.0	0.0
BARIUM	3	3	0.9	0.6	1.1	0.9
BENZENE	3	3	24.1	9.7	51.5	17.7
CALCIUM	3	0	16.8	14.2	21.8	16.5
CHRISTOBALITE	2	2				
CHROMIUM	3	3	0.9	0.6	1.1	0.9
COPPER	3	3	0.9	0.6	1.1	0.9
DICHLOROBENZENE	2	1	16.0	9.7	22.2	14.7
ETHYL ACETATE	2	2	10.4	9.7	11.1	10.4
IRON	3	0	8.2	6.8	9.9	8.1
LEAD	3	2	1.4	1.0	2.1	1.3
LIMONENE	2	0	38.9	31.1	46.6	38.1
MIBK	2	2	10.4	9.7	11.1	10.4
MAGNESIUM	3	1	2.2	1.1	3.5	2.0
NICKEL	3	2	2.5	0.6	6.0	1.5
PERCHLOROETHYLENE	3	1	85.3	48.9	155.3	73.2
QUARTZ	2	0	16.7	8.6	24.7	14.6
SODIUM	3	3	0.9	0.6	1.1	0.9
TITANIUM	3	3	0.9	0.6	1.1	0.9
TOLUENE	3	1	40.2	29.1	51.5	39.2
TOTAL OTHER HYDROCARBONS	3	0	614.1	494.8	828.9	596.9
TOTAL WEIGHT	6	0	192.0	33.3	355.6	145.6
TRICHLORETHANE	2	2	10.4	9.7	11.1	10.4
XYLENE	3	1	44.7	37.8	51.5	44.3
ZINC	3	3	0.9	0.6	1.1	0.9
N-BUTYL ACETATE	2	2	10.4	9.7	11.1	10.4
N-HEXANE	3	3	24.1	9.7	51.5	17.7

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 6

EXPOSURE RESULTS
BY JOB CATEGORY
ATTENDANTS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ALUMINUM	6	1	46.4	1.2	257.7	6.9
ASBESTOS	1	1	0.0	0.0	0.0	.
BARIUM	6	5	2.9	0.7	12.2	1.5
BENZENE	4	3	33.0	12.4	62.5	25.9
CALCIUM	6	0	197.9	4.9	1099.2	28.1
CHROMIUM	6	5	1.2	0.7	1.8	1.1
COPPER	6	5	1.6	0.7	4.6	1.3
DICHLOROBENZENE	2	0	69.0	56.9	81.1	68.0
ETHYL ACETATE	2	2	12.7	12.4	13.1	12.7
IRON	6	1	105.7	1.2	480.7	19.4
LEAD	6	3	5.0	1.1	21.0	2.5
LIMONENE	2	1	85.8	13.1	158.4	45.5
MIBK	2	2	12.7	12.4	13.1	12.7
MAGNESIUM	6	3	26.2	1.1	142.9	4.4
NICKEL	6	6	1.0	0.7	1.4	0.9
PERCHLOROETHYLENE	4	1	142.8	24.3	450.5	69.4
PESTICIDES	4	4				
PNAS	6	6				
SODIUM	6	5	1.6	0.7	4.9	1.2
TITANIUM	6	5	2.9	0.7	12.2	1.5
TOLUENE	4	1	67.1	35.3	126.2	59.3
TOTAL OTHER HYDROCARBONS	4	1	610.1	125.0	1009.9	474.6
TOTAL WEIGHT	6	0	192.0	24.8	287.0	154.0
TRICHLORETHANE	2	1	18.9	13.1	24.8	18.0
XYLENE	4	1	56.8	30.9	84.2	53.3
ZINC	6	5	57.6	0.7	340.3	2.6
N-BUTYL ACETATE	2	2	12.7	12.4	13.1	12.7
N-HEXANE	4	4	24.8	11.0	62.5	18.3

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 7

EXPOSURE RESULTS
BY JOB CATEGORY
CONSTRUCTION AREA

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ALUMINUM	5	1	5.3	0.6	10.3	3.9
BARIUM	5	5	0.6	0.5	0.7	0.6
BENZENE	6	6	54.6	45.0	61.0	54.3
CALCIUM	5	0	30.2	8.0	57.1	24.7
CHROMIUM	5	4	0.7	0.5	1.2	0.7
COPPER	5	4	0.8	0.5	1.3	0.7
DICHLOROBENZENE	2	2	54.7	52.6	56.8	54.7
ETHYL ACETATE	2	2	54.7	52.6	56.8	54.7
IRON	5	0	12.4	3.4	20.5	10.5
LEAD	5	2	1.7	0.6	2.5	1.4
LIMONENE	2	0	211.3	115.8	306.8	188.5
MIBK	2	2	54.7	52.6	56.8	54.7
MAGNESIUM	5	0	4.2	2.2	6.8	3.8
NICKEL	5	5	0.6	0.5	0.7	0.6
PERCHLOROETHYLENE	6	3	398.8	52.1	1534.1	164.1
PESTICIDES	4	4				
PNAS	4	4				
SODIUM	5	5	0.6	0.5	0.7	0.6
TITANIUM	5	4	0.8	0.5	1.5	0.7
TOLUENE	6	3	151.4	52.1	386.4	112.3
TOTAL OTHER HYDROCARBONS	6	2	770.5	113.6	1687.5	493.7
TRICHLORETHANE	2	2	54.7	52.6	56.8	54.7
XYLENE	6	3	143.0	52.1	397.7	106.7
ZINC	5	5	0.6	0.5	0.7	0.6
N-BUTYL ACETATE	2	2	54.7	52.6	56.8	54.7
N-HEXANE	6	6	54.6	45.0	61.0	54.3

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 8

EXPOSURE RESULTS
BY JOB CATEGORY
DEMOLITION WASTE DISPOSAL AREA

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	5	1	4.6	1.4	8.4	3.9
ASBESTOS	1	1	0.0	0.0	0.0	.
BARIUM	5	5	0.8	0.6	1.4	0.7
BENZENE	4	4	42.6	13.7	54.9	37.3
CALCIUM	5	0	13.8	6.8	20.4	12.9
CHRISTOBALITE	1	1				
CHROMIUM	5	4	0.9	0.6	1.4	0.8
COPPER	5	4	0.9	0.6	1.4	0.8
IRON	5	0	10.8	6.6	13.9	10.4
LEAD	5	2	1.5	0.6	2.8	1.3
MAGNESIUM	5	1	2.8	1.4	3.6	2.7
NICKEL	5	5	0.8	0.6	1.4	0.7
PERCHLOROETHYLENE	4	3	46.0	27.4	54.9	44.3
QUARTZ	1	1	4.6	4.6	4.6	.
SODIUM	5	5	0.8	0.6	1.4	0.7
TITANIUM	5	5	0.8	0.6	1.4	0.7
TOLUENE	4	4	42.6	13.7	54.9	37.3
TOTAL OTHER HYDROCARBONS	4	2	128.3	87.7	205.6	121.5
TOTAL WEIGHT	3	1	85.8	7.8	164.4	47.9
XYLENE	4	4	42.6	13.7	54.9	37.3
ZINC	5	4	2.9	0.6	11.2	1.3
N-HEXANE	4	4	42.6	13.7	54.9	37.3

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 9

EXPOSURE RESULTS
BY JOB CATEGORY
EASY PACK

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	4	1	4.4	1.3	9.6	3.4
ASBESTOS	1	1	0.0	0.0	0.0	.
BARIUM	4	4	0.8	0.6	1.3	0.8
BENZENE	4	3	50.8	30.8	62.5	49.1
CALCIUM	4	0	9.4	6.1	12.7	9.1
CHRISTOBALITE	1	1				
CHROMIUM	4	4	0.8	0.6	1.3	0.8
COPPER	4	4	0.8	0.6	1.3	0.8
DICHLOROBENZENE	1	1	12.8	12.8	12.8	.
ETHYL ACETATE	1	1	12.8	12.8	12.8	.
IRON	4	0	17.5	5.6	38.1	13.4
LEAD	4	2	1.2	0.6	1.4	1.1
LIMONENE	1	0	64.1	64.1	64.1	.
MIBK	1	1	12.8	12.8	12.8	.
MAGNESIUM	4	1	1.8	1.3	2.2	1.8
NICKEL	4	4	0.8	0.6	1.3	0.8
PERCHLOROETHYLENE	4	3	58.5	53.2	62.5	58.4
PESTICIDES	4	4				
PNAS	4	4				
QUARTZ	1	1	4.3	4.3	4.3	.
SODIUM	4	4	0.8	0.6	1.3	0.8
TITANIUM	4	4	0.8	0.6	1.3	0.8
TOLUENE	4	3	66.8	53.2	94.9	65.1
TOTAL OTHER HYDROCARBONS	4	2	401.3	106.4	1089.7	253.3
TOTAL WEIGHT	3	0	113.8	87.8	153.8	110.5
TRICHLORETHANE	1	1	12.8	12.8	12.8	.
XYLENE	4	3	64.3	53.2	84.6	63.2
ZINC	4	2	1.7	0.7	2.4	1.5
N-BUTYL ACETATE	1	1	12.8	12.8	12.8	.
N-HEXANE	4	4	46.3	12.8	62.5	39.4

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 10

EXPOSURE RESULTS
BY JOB CATEGORY
ENGINEER

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	2	1	1.4	1.2	1.6	1.4
ASBESTOS	1	1	0.0	0.0	0.0	.
BARIUM	2	2	1.0	0.7	1.2	0.9
BENZENE	2	1	49.3	35.3	63.3	47.3
CALCIUM	2	0	6.9	6.8	6.9	6.9
CHROMIUM	2	2	1.0	0.7	1.2	0.9
COPPER	2	2	1.0	0.7	1.2	0.9
DICHLOROBENZENE	2	1	95.2	63.3	127.1	89.7
ETHYL ACETATE	2	2	37.5	11.8	63.3	27.3
IRON	2	0	3.3	2.8	3.8	3.3
LEAD	2	2	1.0	0.7	1.2	0.9
LIMONENE	2	1	46.9	30.6	63.3	44.0
MIBK	2	2	37.5	11.8	63.3	27.3
MAGNESIUM	2	1	2.2	1.2	3.1	1.9
NICKEL	2	2	1.0	0.7	1.2	0.9
PERCHLOROETHYLENE	2	0	123.2	56.5	189.9	103.5
PNAS	2	2				
SODIUM	2	2	1.0	0.7	1.2	0.9
TITANIUM	2	2	1.0	0.7	1.2	0.9
TOLUENE	2	1	61.1	58.8	63.3	61.0
TOTAL OTHER HYDROCARBONS	2	0	1738.6	1493.7	1983.5	1721.3
TOTAL WEIGHT	1	0	352.9	352.9	352.9	.
TRICHLORETHANE	2	1	46.9	30.6	63.3	44.0
XYLENE	2	1	61.1	58.8	63.3	61.0
ZINC	2	2	1.0	0.7	1.2	0.9
N-BUTYL ACETATE	2	2	37.5	11.8	63.3	27.3
N-HEXANE	2	2	37.5	11.8	63.3	27.3

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 11

EXPOSURE RESULTS
BY JOB CATEGORY
GARBAGE DISPOSAL AREA

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ALUMINUM	9	1	7.7	1.2	36.0	4.4
ASBESTOS	2	2	0.0	0.0	0.0	0.0
BARIUM	9	8	0.9	0.6	1.9	0.8
BENZENE	9	7	65.4	22.2	178.6	56.8
CALCIUM	9	0	43.1	7.1	182.8	25.2
CHRISTOBALITE	2	2				
CHROMIUM	9	7	0.9	0.6	1.4	0.8
COPPER	9	8	0.8	0.6	1.5	0.8
DICHLOROBENZENE	5	3	84.3	46.7	178.6	73.2
ETHYL ACETATE	5	3	125.8	48.1	224.4	106.1
IRON	9	0	24.4	3.4	120.0	12.2
LEAD	9	3	2.4	0.6	7.9	1.9
LIMONENE	5	0	708.3	340.0	1750.0	582.3
MIBK	5	4	77.6	12.2	178.6	56.1
MAGNESIUM	9	1	6.5	1.2	30.8	3.8
NICKEL	9	9	0.8	0.6	1.2	0.7
PERCHLOROETHYLENE	9	2	1765.4	12.2	7107.1	522.8
PESTICIDES	4	4				
PNAS	4	4				
QUARTZ	2	1	5.9	3.7	8.1	5.5
SODIUM	9	9	0.8	0.6	1.2	0.7
TITANIUM	9	7	1.1	0.6	2.5	0.9
TOLUENE	9	3	570.5	49.5	1714.3	290.0
TOTAL OTHER	9	2	3309.7	99.0	17285.7	1104.5
HYDROCARBONS						
TOTAL WEIGHT	6	0	144.8	17.3	333.3	104.9
TRICHLORETHANE	5	0	650.2	66.7	1535.7	310.3
XYLENE	9	4	414.2	49.5	1750.0	197.6
ZINC	9	5	2.6	0.6	10.3	1.6
N-BUTYL ACETATE	5	3	68.7	24.4	178.6	53.0
N-HEXANE	9	7	73.0	48.1	178.6	67.0

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 wer below the analytical limit of detection.

2. The following additional elements were analyzed, but were below th limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mr Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 12

EXPOSURE RESULTS
BY JOB CATEGORY
INFORMATION PERSONNEL

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
BENZENE	1	1	56.8	56.8	56.8	.
PERCHLOROETHYLENE	1	1	56.8	56.8	56.8	.
TOLUENE	1	1	56.8	56.8	56.8	.
TOTAL OTHER HYDROCARBONS	1	0	897.7	897.7	897.7	.
XYLENE	1	1	56.8	56.8	56.8	.
N-HEXANE	1	1	56.8	56.8	56.8	.

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 13

EXPOSURE RESULTS
BY JOB CATEGORY
MECHANICS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	2	1	2.4	1.2	3.6	2.1
BARIUM	2	2	1.2	1.1	1.2	1.2
BENZENE	4	1	242.9	11.2	449.3	134.0
CALCIUM	2	0	17.0	12.4	21.6	16.4
CHROMIUM	2	2	1.2	1.1	1.2	1.2
COPPER	2	2	1.2	1.1	1.2	1.2
DICHLOROBENZENE	2	2	42.4	12.4	72.5	30.0
ETHYL ACETATE	2	2	42.4	12.4	72.5	30.0
IRON	2	0	6.9	3.2	10.6	5.8
LEAD	2	1	2.5	1.2	3.8	2.2
LIMONENE	2	1	78.7	12.4	144.9	42.4
MIBK	2	2	42.4	12.4	72.5	30.0
MAGNESIUM	2	1	2.4	1.2	3.6	2.1
NICKEL	2	2	1.2	1.1	1.2	1.2
PERCHLOROETHYLENE	4	3	62.6	11.2	109.2	47.5
SODIUM	2	2	1.2	1.1	1.2	1.2
TITANIUM	2	2	1.2	1.1	1.2	1.2
TOLUENE	4	0	1083.8	344.8	2143.8	886.8
TOTAL OTHER HYDROCARBONS	4	0	10603.8	6241.4	17813.5	9802.6
TOTAL WEIGHT	3	0	1124.5	148.9	2752.8	578.3
TRICHLORETHANE	2	0	281.5	186.1	376.8	264.8
XYLENE	4	0	1314.0	356.3	2979.8	982.9
ZINC	2	2	1.2	1.1	1.2	1.2
N-BUTYL ACETATE	2	2	42.4	12.4	72.5	30.0
N-HEXANE	4	1	866.7	57.5	1550.7	516.2

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 14

EXPOSURE RESULTS
BY JOB CATEGORY
OFFICE WORKERS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
BENZENE	2	1	117.6	64.9	170.2	105.1
DICHLOROBENZENE	1	1	53.2	53.2	53.2	.
ETHYL ACETATE	1	1	53.2	53.2	53.2	.
LIMONENE	1	1	53.2	53.2	53.2	.
MIBK	1	1	53.2	53.2	53.2	.
PERCHLOROETHYLENE	2	2	59.1	53.2	64.9	58.8
TOLUENE	2	1	192.0	64.9	319.1	144.0
TOTAL OTHER HYDROCARBONS	2	0	1771.4	766.2	2776.6	1458.6
TRICHLORETHANE	1	0	138.3	138.3	138.3	.
XYLENE	2	1	170.8	64.9	276.6	134.0
N-BUTYL ACETATE	1	1	53.2	53.2	53.2	.
N-HEXANE	2	1	341.0	64.9	617.0	200.2

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 15

EXPOSURE RESULTS
BY JOB CATEGORY
OFFICERS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	4	0	4.2	3.4	5.1	4.1
ASBESTOS	2	0	0.0	0.0	0.0	0.0
BARIUM	4	4	1.0	0.6	1.6	0.9
BENZENE	3	1	44.6	31.6	58.8	43.2
CALCIUM	4	0	20.1	13.9	29.2	19.1
CHROMIUM	4	4	1.0	0.6	1.6	0.9
COPPER	4	4	1.0	0.6	1.6	0.9
DICHLOROBENZENE	2	1	70.6	11.4	129.8	38.4
ETHYL ACETATE	2	1	259.0	15.8	502.3	89.1
IRON	4	0	10.6	6.3	15.0	10.1
LEAD	4	1	2.3	1.6	3.0	2.2
LIMONENE	2	0	72.4	38.0	106.8	63.7
MIBK	2	2	13.6	11.4	15.8	13.4
MAGNESIUM	4	0	4.4	3.2	5.8	4.3
NICKEL	4	4	1.0	0.6	1.6	0.9
PERCHLOROETHYLENE	3	0	88.7	52.3	141.2	81.3
SODIUM	4	2	2.3	0.6	4.4	1.6
TITANIUM	4	3	1.1	0.7	1.6	1.1
TOLUENE	3	1	443.1	58.8	1197.7	172.4
TOTAL OTHER HYDROCARBONS	3	0	995.0	376.5	1829.1	812.7
TOTAL WEIGHT	2	0	306.4	158.2	454.5	268.2
TRICHLORETHANE	2	1	19.3	15.8	22.7	19.0
XYLENE	3	1	69.5	58.8	86.4	68.5
ZINC	4	4	1.0	0.6	1.6	0.9
N-BUTYL ACETATE	2	1	386.3	15.8	756.8	109.4
N-HEXANE	3	2	44.6	15.8	59.1	38.0

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 16

EXPOSURE RESULTS
BY JOB CATEGORY
PAYLOADER OPERATOR

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	NUMBER OF SAMPLES	NUMBER BELOW LOD	MEAN ug/m3	MINIMUM VALUE ug/m3	MAXIMUM VALUE ug/m3	GEOMETRIC MEAN ug/m3
ALUMINUM	1	0	5.4	5.4	5.4	.
BARIUM	1	1	0.7	0.7	0.7	.
BENZENE	1	1	57.5	57.5	57.5	.
CALCIUM	1	0	19.6	19.6	19.6	.
CHROMIUM	1	1	0.7	0.7	0.7	.
COPPER	1	1	0.7	0.7	0.7	.
IRON	1	0	10.3	10.3	10.3	.
LEAD	1	0	1.4	1.4	1.4	.
MAGNESIUM	1	0	4.5	4.5	4.5	.
NICKEL	1	1	0.7	0.7	0.7	.
PERCHLOROETHYLENE	1	1	57.5	57.5	57.5	.
SODIUM	1	1	0.7	0.7	0.7	.
TITANIUM	1	1	0.7	0.7	0.7	.
TOLUENE	1	1	57.5	57.5	57.5	.
TOTAL OTHER HYDROCARBONS	1	1	114.9	114.9	114.9	.
XYLENE	1	1	57.5	57.5	57.5	.
ZINC	1	0	8.8	8.8	8.8	.
N-HEXANE	1	1	57.5	57.5	57.5	.

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 17

EXPOSURE RESULTS
BY JOB CATEGORY
SCALE AREA

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	6	1	2.9	1.0	3.9	2.6
ASBESTOS	3	3	0.0	0.0	0.0	0.0
BARIUM	6	6	0.8	0.5	1.0	0.7
BENZENE	8	6	55.7	10.2	128.2	42.4
CALCIUM	6	0	15.1	8.8	18.6	14.6
CHROMIUM	6	6	0.8	0.5	1.0	0.7
COPPER	6	6	0.8	0.5	1.0	0.7
DICHLOROBENZENE	3	2	13.7	9.6	21.4	12.8
ETHYL ACETATE	3	3	9.8	9.6	10.2	9.8
IRON	6	0	7.1	4.0	9.1	6.9
LEAD	6	2	1.7	1.0	2.8	1.5
LIMONENE	3	2	13.9	9.6	22.4	12.8
MIBK	3	3	9.8	9.6	10.2	9.8
MAGNESIUM	6	0	3.9	2.7	4.8	3.8
NICKEL	6	6	0.8	0.5	1.0	0.7
PERCHLOROETHYLENE	8	5	61.8	23.3	128.2	53.5
PESTICIDES	6	6				
PNAS	6	6				
SODIUM	6	4	1.6	0.5	3.5	1.1
TITANIUM	6	6	0.8	0.5	1.0	0.7
TOLUENE	8	3	105.6	42.7	175.0	96.8
TOTAL OTHER HYDROCARBONS	8	4	346.0	96.2	687.8	281.1
TOTAL WEIGHT	3	0	238.8	153.8	387.8	218.5
TRICHLORETHANE	3	2	16.3	9.7	28.8	14.2
XYLENE	8	5	69.2	38.8	128.2	63.4
ZINC	6	5	1.2	0.6	3.0	1.0
N-BUTYL ACETATE	3	2	40.6	9.7	101.9	21.6
N-HEXANE	8	7	55.2	9.6	128.2	39.5

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 additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 18

EXPOSURE RESULTS
BY JOB CATEGORY
UTILITY WORKERS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

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
ALUMINUM	2	2	1.4	1.3	1.5	1.4
BARIUM	2	2	1.4	1.3	1.5	1.4
BENZENE	4	2	99.8	54.3	228.9	80.4
CALCIUM	2	0	12.8	4.2	21.4	9.5
CHROMIUM	2	2	1.4	1.3	1.5	1.4
COPPER	2	2	1.4	1.3	1.5	1.4
DICHLOROBENZENE	2	0	152.3	121.0	183.5	149.0
ETHYL ACETATE	2	1	51.1	15.3	86.8	36.4
IRON	2	1	8.1	1.3	15.0	4.4
LEAD	2	2	1.4	1.3	1.5	1.4
LIMONENE	2	2	14.2	13.2	15.3	14.2
MIBK	2	2	14.2	13.2	15.3	14.2
MAGNESIUM	2	1	2.6	1.3	4.0	2.3
NICKEL	2	2	1.4	1.3	1.5	1.4
PERCHLOROETHYLENE	4	2	58.6	54.3	61.2	58.5
SODIUM	2	2	1.4	1.3	1.5	1.4
TITANIUM	2	2	1.4	1.3	1.5	1.4
TOLUENE	4	2	199.8	54.3	555.3	124.0
TOTAL OTHER HYDROCARBONS	4	2	2031.5	108.7	6684.2	572.3
TOTAL WEIGHT	5	0	174.7	24.1	367.0	126.6
TRICHLORETHANE	2	1	86.6	15.3	157.9	49.1
XYLENE	4	2	152.0	54.3	376.3	109.7
ZINC	2	2	1.4	1.3	1.5	1.4
N-BUTYL ACETATE	2	2	14.2	13.2	15.3	14.2
N-HEXANE	4	2	162.1	48.9	484.2	94.1

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.

2. The following additional elements were analyzed, but were below the limit of detection in all samples: Ag, As, Be, Cd, Co, La, Li, Mn, Mo, Ni, P, Pt, Sb, Se, Sn, Sr, Te, Tl, W, Y, Zr.

TABLE 19

NOISE DOSIMETER RESULTS
FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 17, 1983

Job Location	Sample Duration	Cumulative Exposure (dB)	Highest Single Hour (dB)
Tractor	6+48	82.9	88.3
Tractor	6+53	86.5	89.2
Bulldozer	6+19	89	92.5
Tractor	6+23	90.4	93.8
Tractor	6+23	90.6	96.0
Bulldozer	5+13	91.2	95.4
Bulldozer	2+22	92.2	94.9
Bulldozer	6+04	92.9	96.9
Bulldozer	6+30	93	95.3
Rex Machine	3+18	94.2	96.1
Rex Machine	6+28	95.5	100.7

APPENDIX I

SAMPLING AND ANALYSIS METHODOLOGY

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

SEPTEMBER 26-28, 1982

SUBSTANCE	COLLECTION DEVICE	FLOW RATE (LPM)	DURATION (HR)	ANALYTIC METHOD	LOD UG
Asbestos	Mixed Cellulose Polyester Filter	1.7	5-8	PCM	4500 f/f
Elemental Analysis (Metals)	Mixed Cellulose Polyester Filter	1.75	5-8	ICP/AES	1
Free Silica	Mixed Cellulose Polyester Filter	1.75	5-8	XRD	30
Organic Vapors	Charcoal Tube	0.2	5-8	GC/MS	1-10
Particle Size Distribution	Miniature Cascade Impacter	2.0	5-8	Gravi-metric	
Pesticides	Teflon Filter Porpos Polymer	0.5		GC/FID GC/EC	0.05
PNAs	Glass Fiber Filter Chromosorb 102	0.2	5-8	HRGC/MS	0.05
Total Weight	Miniature Cascade Impacter	2.0	5-8	Gravi-metric	

NOTES: 1. f/f means fibers per filter; GC/MS means gas chromatography and mass spectrometry; ICP/AES means inductively couples plasma atomic emission spectormetry; XRD means X-ray diffraction; GC/FID means gas chromatography with flame ionization detection; GC/EC means gas chromatography with electron capture detection; HRGC/MS means high resolution gas chromatography/mass spectrometry.

APPENDIX II

EVALUATION CRITERIA
ORGANIC VAPORS

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

	ACGIH	OSHA	NIOSH
All criteria are expressed as 8-hr TWAs in units of ug/m^3, except as noted			
BENZENE	30,000	30,000	3,000C
TOLUENE	375,000	750,000	375,000
XYLENE	435,000	435,000	435,000
n-HEXANE	180,000	1,800,000	
PERCHLOROETHYLENE	335,000	670,000	335,000
DICHLOROBENZENE	450,000	450,000	
1,1,1 TRICHLOROETHANE	1,900,000	1,900,000	1,900,000C1
n-BUTYL ACETATE	710,000	710,000	
ETHYL ACETATE	1,400,000	1,400,000	
MIBK	205,000	410,000	200,000
CARBON MONOXIDE	55,000	55,000	35,000

NOTES:
C Designates a 60-minute ceiling concentration.
C1 Designates a 15-minute ceiling concentration.

APPENDIX III

EVALUATION CRITERIA
PARTICULATES

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

ASBESTOS

OSHA: 2 fibers/cc with a ceiling limit of 10 fibers/cc.

ACGIH: Amosite 0.5 fibers >5um/cc
Chrysotile 2 fibers >5um/cc
Crocidolite 0.2 fibers >5um/cc
Others forms 2 fibers >5um/cc

NIOSH 0.1 fibers >5um/cc

QUARTZ

OSHA $[10mg/m^3]/[\%SiO_2+2]$

ACGIH $[10mg/m^3]/[\%SiO_2+2]$

NIOSH

TOTAL DUST (Respirable)

OSHA 5000 ug/m^3
ACGIH 5000 ug/m^3

LEAD

OSHA 50 ug/m^3
ACGIH 150 ug/m^3
NIOSH 50 ug/m^3

APPENDIX IV

EVALUATION CRITERIA
NOISE

FOUNTAIN AVENUE LANDFILL
BROOKLYN, NEW YORK

OSHA:

29 CFR 1910.95 Occupational Noise Exposure
(a) Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table G-16 when measured on the A scale of a standard noise level meter at slow response . . . .

Table G-16-Permissible Noise Exposures[1]

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

[1]When the daily noise exposure is composed of two or more periods of noise esposure of different levels, their combined effect should be considereed rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 + \ldots C_n/T_n$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at that level.

NIOSH

(Reference: Criteria for a Recommended Standard for Occupational Exposure to Noise, NIOSH, Rockville, MD, NTIS Publication No PB-213 463, Page I-3)

Occupational noise exposure shall be controlled so that no worker shall be exposed in excess of the limit described as line B in Figure I-1. New installations shall be designed with noise control so that the noise exposure does not exceed the limits described as line A in Figure I-1. For noise exposures consisting of two or more periods of exposure at different levels, the Daily Noise Dose, D, shall not exceed unity. Line A or line B, as applicable shall be used in computing the Daily Noise Dose.