



Memorandum

Date . OCT 21 1986

From Acting Director
Office of Health AssessmentSubject Health Assessment, Lipari Landfill (SI-86-002B)
Gloucester County, New JerseyTo Mr. William Nelson
Public Health Advisor
EPA Region IIEXECUTIVE SUMMARY

The Agency for Toxic Substances and Disease Registry (ATSDR) has been requested by the U.S. Environmental Protection Agency (EPA), Region II, to perform a health assessment based on data resulting from the analysis of soil samples collected from three park and recreational areas (Alcyon Park, Betty Park, and Hollywood Dell Recreation Area), and from six residences located on Lakeside Avenue, Pitman, New Jersey. Average combined pesticide levels (DDT and its residues) in soils did not exceed 1 ppm (part per million) at any site (range: ND - 3.7 ppm). Five samples, within 50 feet of three residences on Lakeview Avenue had a mean chlordane concentration of 1.462 ppm (range: 0.780-2.900). Polyaromatic hydrocarbons (PAH's) in concentrations up to 4.200 ppm were found in 5 of 43 samples. Chlordane was found in 5 of 43 samples at a mean concentration of 1.462 ppm (range: 0.780-2.900).

Soil concentrations of DDT, DDE, DDD, and polyaromatic hydrocarbons concentrations do not represent a public health risk. Since there was no chlordane found around three of the six residences or in areas greater than 50 feet away from the other houses, the measured chlordane concentrations probably represent past chlordane use in and/or around the three residences in question. These levels do not present a risk for systemic toxicity. The very low estimated carcinogenic risk (1.68×10^{-5}) if a child ingests 0.5 grams of these soils per day is probably overestimated because these estimates are based upon lifetime exposure, and land usage patterns make it unlikely that 0.5 grams of the soils in

question would be consumed per day. It is recommended that prudent, hygienic, everyday practices of hand washing after yard work, and thorough washing of vegetables grown in these yards be done.

Location and Land Use

The Lipari Landfill, ranked #1 on the October 1984 EPA National Priorities List, is an approximately 15-acre site located in a mixed agricultural and residential area adjacent to the towns of Pitman and Glassboro.

Approximately 1500 feet north (downstream of the site), Chestnut Branch empties into the 26-acre man-made Alcyon Lake. Betty Park and Alcyon Park border Alcyon Lake to the northeast and northwest respectively. Hollywood Dell Recreational Area lies northeast of, and immediately downstream from, the spillway which empties Alcyon Lake. The six Lakeside Avenue residences border the southeast shore of Alcyon Lake (Docs. #1 & #2).

DOCUMENTS REVIEWED

- Doc. #1 Evaluation of Analytical Data From Park and Recreation Areas in Proximity to the Lipari Landfill, Gloucester County, New Jersey, EPA Contract No. 68-01-6699, Technical Directive Document No. 02-8510-02H; prepared for U.S. EPA Environmental Services Division by NUS Corporation, September 3, 1986.
- Doc. #2 Data Presentation for Residential Soil Sampling, Program Lipari Landfill, Gloucester County, New Jersey, EPA Contract No. 68-01-6699, Technical Directive Document No 02-8510-02G; for U.S. EPA Environmental Services Division by NUS Corporation, September 16, 1986.
- Doc. #3 Analytical data package for Lipari Residential Soil Samples (Organics Analysis Data Sheets)

Doc. #4 Analytical data package for Lipari Residential Soil Samples
(Inorganic Analysis Sheets).

Principle Contaminants

Five soil samples (0 to 2 inches deep) were collected at random locations from each of the three parks plus a control area (areas located outside the 100 year flood plain of the Aloyon Lake drainage basin). One replicated sample was obtained from each park area, as well as seven biased samples (from intensive use areas). These soil samples were analyzed for four pesticides: chlordanes, 4,4'-DDT, 4,4'-DDD and 4,4'-DDE.

Residential soil sampling consisted of 39 surface samples (0 to 6 inches deep) taken on grid nodes determined by a 50 by 50 foot grid sampling design. Four soil samples were obtained at biased locations located near the shore of Lake Aloyon. These soils were analyzed for organic and inorganic compounds.

Pesticide levels measured in the park areas are found in Table 5.1 (Doc. 1). The average combined pesticide concentrations are summarized below in Table I. (modified from Table 5.2 Doc. 1). No chlordanes were found.

<u>Location</u>	<u>Average Pesticide Concentration*</u>	<u>Range Pesticide Concentrations</u>
Aloyon Park (control area)	0.015	(ND -0.032)
Aloyon Park (flood plain- random)	0.119	(ND -0.287)
Aloyon Park (flood plain- biased)		(J -0.128)
Betty Park (flood plain- random)	0.997	(0.132-3.700)

Betty Park
(flood plain-
biased)

0.500 *

Hollywood Dell
Rec. Area
(flood plain-
random)

0.009

(ND- 0.012)

Hollywood Dell
Rec. Area
(flood plain-
biased)

ND

* =sum of 4,4'-DDT, 4,4'-DDE and 4,4'-DDD

ND=soil pesticide not detected

J =compound is present, but below the specified detection limit

* =based upon one sample

Residential soils were analyzed for both organic and inorganic compounds. These results are summarized within Attachment 2 (Doc. #2). Inorganic compounds were found in a range typical of urban soils. The detected organic compounds were various polycyclic aromatic hydrocarbons (PAH's) and the following pesticides and pesticide metabolites: chlordanes, 4,4'-DDT, 4,4'-DDE and 4,4'-DDD.

Up to eight PAH compounds were found in five soil samples and at concentrations up to 4200 ug/kg (ppb). The three biased samples which contained PAH's are described as "located near a railroad tie retaining wall on the edge of Lake Alcyon." These samples had the greatest number of detected PAH compounds and at the highest concentrations. Another sample is described as being located "near a fence post which may have been creosote treated." Of the remaining one sample, it had 470 ug/kg chrysene; all other PAH's were non-quantifiable.

The Table II describes the pesticide concentrations found within soil samples.

Pesticide	Mean Pesticide Concentration (mg/kg or ppm)	Range Pesticide Concentrations (mg/kg or ppm)
4,4'-DDT (21 samples)*	0.219	0.017-1.700
4,4'-DDE (16 samples)	0.143	0.019-0.540
4,4'-DDD (5 samples)	0.028	0.015-0.050
combined pesticide average**	0.314	0.023-2.240
chlordanes (5 samples)	1.462	0.780-2.900

* =number of samples in which pesticides were detected at or above the specified detection limit
 **=sum of 4,4'-DDT, 4,4'-DDE and 4,4'-DDD

HUMAN CONTAMINATION PATHWAYS

Human exposure to chemicals within soils found in the park and residential areas of concern may occur secondary to (1) dermal absorption of a chemical or chemical mixture by direct contact with the soil, (2) ingestion of soil, and/or (3) inhalation of air which has been contaminated with chemical(s) by the processes of (a) chemical volatilization and/or (b) mechanical dispersion of contaminated dusts or aerosols.

DISCUSSION

The following discussion will consider the potential for human exposure posed by the polychlorinated aromatic hydrocarbons, pesticides, and pesticide residues found in the surveyed park and residential soils

examined by EPA. The park and residential soils will be discussed separately.

The park soil samples were obtained from depths of 0 to 2 inches and should be representative of soil to which individuals utilizing park lands would potentially be exposed. Random, as well as biased samples (stated to represent areas of most intensive recreational use) are reported. The concentrations of DDT and its related metabolites are below an average (1.42 ppm) found on city lands (400 sites sampled).(1)

DDT can be absorbed via ingestion, inhalation, and dermal absorption. These routes of absorption can be modified by the availability in the soil. DDT is a hydrophobic hydrocarbon and its soil adsorption characteristics are felt to resemble those of PCB's (polychlorinated biphenyls) which adsorb strongly to soils rich in organic matter and poorly to sandy soils.(2) If the DDT is tightly bound it may be less likely to be absorbed through the skin, and would be less likely to volatilize from the soil. Inhalation of dusts generated from these soils would be infrequent and represent only a small fraction of total soil exposure. Therefore, the most likely route for DDT exposure would be through ingestion of soil, either by direct mouth ingestion, or via mucous clearance of dust that has impacted the upper respiratory tract. If DDT was less tightly bound to soil, there might be a greater opportunity for dermal absorption. However, because of the low pesticide concentration levels found in these soils, this route will not be considered.

The allowable daily intake (ADI) of DDT is 0.005 (mg/kg)/day.(3) Therefore, the ADI for a 70 kg adult is 0.35 mg DDT/day and for a 10 kg child is 0.05 mg DDT/day. Caution should be exercised when applying ADI calculations to children because an ADI is based upon a lifetime exposure and may overestimate the risk. In a recent, yet to be published, Centers for Disease Control (CDC) investigation, it was found that children of the soil-ingesting age consumed about 0.5 g/day (range 0.1 to 1.0 g/day).(4)

If one assumes that a young child might consume 0.5 grams dirt/day, and that an adult might consume 0.1 grams of dirt/day, then in Betty Park, having the highest combined pesticide concentration (DDT plus residues = approximately 1.0 ug/gr), soil ingestion would range from 0.5 to 0.1 ug DDT/day, respectively. This represents 1 percent of the ADI for children and less than 1 percent of the ADI for adults. However, these calculations probably overestimate chlordane consumption because (1) these areas may not be utilized during times of inhospitable weather, and (2) the estimates for soil consumed per day should include soils from all sources.

The Occupational Health and Safety Administration's (OSHA) standard for DDT exposure in the workplace is 1 mg/m³ as a time-weighted average over a 40-hour work week. A worker may be exposed to 0.038 mg DDT/day in his/her work air (assumes sedentary work where tidal volume = 0.5 liters, breaths/minute = 16, workshift = 8 hours).

The measured levels of 4,4'-DDT, 4,4'-DDE and 4,4'-DDD found in Betty Park, Aloyon Park, and Hollywood Dell Recreation Area do not represent a public health threat.

The Lakeside Avenue residential soil samples were obtained from depths of 0 to 6 inches and should be representative of soils that might be encountered during typical gardening activities.

The average combined pesticide (DDT plus metabolites) concentration is less than that encountered in Betty Park. The potential for DDT exposure at somewhat higher concentrations have been discussed above.

Chlordane was found in 5 of 43 residential soil samples at an average concentration of 1.462 ppm (range 0.780-2.900 ppm). The average concentration of chlordane is above a mean of 0.67 ppm found on city lands (400 sites sampled) and below a mean of 1.51 ppm found on city grasslands

(119 sites sampled).(1) The five samples were obtained within 50 feet of three of the houses. No information is available to determine if and when these houses and/or soils had been treated with chlordane.

Chlordane can be absorbed via ingestion, inhalation, and skin absorption. These routes of absorption can be modified by its availability in the soil. Because chlordane is also a hydrophobic hydrocarbon, its soil adsorption characteristics will be assumed to be similar to DDT for this discussion. Potential human exposure pathways for chlordane are similar to DDT as discussed above.

The EPA reference dose for oral exposure is 0.05 ug/kg/day based upon systemic toxicity.(5) A 70 kg adult potentially may ingest 3.50 ug chlordane/day, and a 10 kg child, 0.50 ug chlordane/day. The average soil chlordane concentration for the five samples was 1.46 ug/gr (ppm). Therefore, if 0.1 to 0.5 grams of soil per day were ingested, chlordane intake would be between 0.146 and 0.730 ug, respectively. At 0.5 grams of soil per day, the 10 kg child might consume more than the EPA reference dose. However, these calculations probably overestimate chlordane consumption because (1) these areas may not be utilized during times of inhospitable weather, and (2) the estimates for soil consumed per day should include soils from all sources. Therefore, chlordane consumption from these soils is probably less. Caution should be exercised when applying ADI calculations to children because an ADI is based upon a lifetime exposure and may overestimate the risk.


The carcinogenicity of chlordane has been demonstrated in several rat and mouse long-term assays. The human carcinogenic lifetime risk has been calculated for ingestion of 0.1 and 0.5 gr of soil containing 1.46 ug chlordane/gr and is estimated to be 3.4×10^{-6} and 1.68×10^{-5} , respectively. These risk estimates are probably high because the chlordane exposure posed by the soil is probably overestimated as discussed above.

The Occupational Safety Health and Administration's (OSHA) has set workplace safety standards of 500 ug/m³ (0.5 ppm) as an 8 hour time-weighted average for a 40 hour work week. This allows the inhalation of 1920 ug chlordanes per workshift (assumes sedentary work where tidal volume = 0.5 liters, breaths/minute = 16, workshift = 8 hours).

The polyaromatic hydrocarbons were found in only 5 of 43 soil samples. Of these, the three with the highest concentrations were localized around a railroad tie retaining wall presumed to be treated with creosote. There is no evidence that there is a pervasive contamination of residential soils with PAH's. A number of PAH's have been determined to be carcinogens, most notably benzo(a)pyrene; however, the PAH levels found within these soil samples are within background ranges.

CONCLUSIONS AND RECOMMENDATIONS

Soil concentrations of DDT, DDE, and DDD measured at both recreational and residential sites do not represent a public health risk. Polyaromatic hydrocarbon concentrations measured in five residential soil samples are below background levels and do not represent a public health risk. Since there was no chlordanes found around three of the six residences or in areas greater than 50 feet away from the other houses, the measured chlordanes concentrations (mean = 1.462 ppm from 5 of 43 samples), probably represent past chlordanes use in and/or around the three residences in question. These levels do not present a risk for systemic toxicity. There is a low carcinogenic risk (1.68×10^{-5}) if a child ingests 0.5 grams of these soils per day. However, it is unlikely that these particular soil sample areas would represent the sole source of soil ingestion on every day, and it seems unlikely that all of the chlordanes would be absorbed. It is recommended that prudent, hygienic, everyday practices of hand washing after yard work, and thorough washing of vegetables grown in these yards be done.


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REFERENCES

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2. Eds. Doull J., Klaassen C., and Amdur M., Casarett and Doull's Toxicology 2nd Edition, Macmillan Publishing Co., Inc., New York, 1980.
3. DDT and Its Derivatives, Environmental Health Criteria 9: World Health Organization, Geneva, 1979.
4. Suzanne Binder, MD, CEH, CDC, personal communication.
6. EPA Research and Development, Verified Reference Doses (RfDs) of the U.S. EPA., ECAO-CIN-475, January 1986.