



Memorandum

Date NOV - 5 1987

From Environmental Health Scientist
Health Sciences Branch, OHA

Subject Health Assessment: *Diamond Alkali*
80 Lister Avenue NPL Site (SI-87-131)
Newark, New Jersey

To Ms. Denise Johnson
Public Health Advisor
EPA Region II
Through: Director, OHA *SVA for MB*
Health Assessment Coordination Activity, OHA *ZJA*
Chief, Health Sciences Branch, OHA *[Signature]*

EXECUTIVE SUMMARY

The Agency for Toxic Substances and Disease Registry (ATSDR) reviewed the information provided in the Feasibility Study (FS) for the 80 Lister Avenue Site, Newark, New Jersey. On-site soil concentrations pose a significant public health threat to workers involved in remedial site activities and possibly nearby workers and area residents. Direct contact should not occur. Groundwater beneath the site poses a potential public health threat to users; use for drinking, bathing, showering, washing, and cooking should not be permitted. Moreover, assurances should be provided that wells in the vicinity of the site are not used for these purposes. Fish flesh and shellfish sampling data from the Passaic River was not provided to ATSDR for review and, therefore, we are unable to determine the public health risk from this exposure pathway.

ATSDR is unable to comment on the remedial alternatives without more information on the risk of exposure to nearby workers, area residents, and on-site workers as a result of reentrainment of contaminant-laden soil and dust during remediation activities. Stipulations put forth in contingency

plans regarding the containment of fugitive dusts and volatiles and decontamination of structures cannot be evaluated with respect to safety from a public health perspective without more information.

STATEMENT OF THE PROBLEM

ATSDR has been requested by the Environmental Protection Agency (EPA) to prepare a health assessment on the Lister Avenue Site (LAS), Newark, New Jersey.

BACKGROUND

The 3.4-acre site is located in the Ironbound Section in Newark, New Jersey. LAS is bounded on the north by the Passaic River, on the east, southeast, south, and west by various heavy industries. LAS is fenced, including the side adjoining the Passaic River. A 24-hour security guard is placed at the only gate providing access to the property. The entire site, excluding areas covered by buildings and equipment, is covered by a black geotextile fabric weighted down by concrete blocks to prevent surface erosion and migration of dust. In addition, monitoring wells have been installed around the site.

Four major structures (a chemical manufacturing building, the process building, the warehouse, and the office and laboratory building) are located on-site. A portion of the property to the east of the site (120 Lister Avenue) is included with the LAS. A brick building along with 345 stored containers are located at 120 Lister Avenue. It is anticipated that approximately 800 to 900 containers ~~will~~ be stored at the site.

History

Between 1951 to 1969, Diamond Alkali Company operated a chemical plant at this site and manufactured the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). As a result, dioxins were produced as a contaminant during the production process.

On-site contamination was evaluated by the New Jersey Department of Environmental Protection (NJDEP) in May 1983. The contaminant 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was detected at 60 parts per billion (ppb) at the south gate and 51,000 ppb under a storage tank. Extensive sampling has been performed to define areas of contamination on-site along transportation routes away from the plant, on streets surrounding the plant, in the "farmers" market, from homes near the plant, from air cleaners of nearby industrial buildings, and from the river and an area across the river. A total of 532 dioxin samples and 122 priority pollutant samples were analyzed. In addition, in June 1983, NJDEP collected nine off-site soil samples. The results demonstrated off-site TCDD contamination ranging from not-detected to 15 parts per billion (ppb). In addition, NJDEP conducted dermatologic examinations of 73 individuals from the area with skin lesions and medical examinations. It was reported that seven individuals seen at the dermatologic clinic had lesions compatible with chloracne or porphyria cutanea tarda (PCT).

Objectives of the FS

The focus of the FS is to eliminate, to the maximum extent practicable, exposure to surface soils containing dioxin, but only on the plant site itself. The objectives stated in the FS include the following:

1. Eliminate, to the maximum extent practicable, exposure to surface soils. Concentrations of dioxin in the surface soils are at levels sufficiently higher than those established by the EPA, Centers for Disease Control (CDC), and NJDEP for public health and environmental protection to warrant site remediation.
2. Reduce mass transport of chemicals in the groundwater to potential concentration levels less than 5×10^{-5} ug/L for dioxin and 0.23 ug/L for DDT at the nearest off-site well at some time in the future. These values represent recommended exposure (10^{-5} cancer risk) levels for ingestion of water.

3. Remove the source of potential particulate dioxin emissions associated with existing buildings.
4. Eliminate mass transport of chemicals from the site to the Passaic River.
5. Implement remediation without significant risk to site workers and off-site populations.

The FS addresses remedial action for the property at 80 and 120 Lister Avenue in Newark, NJ. Off-site remediation of existing contamination, including remediation measures regarding contamination of the Passaic River, is not addressed. However, document 1 states that "Although the FS does not address the cleanup of existing off-site contamination, the assessment of the remedial alternatives should evaluate whether these alternatives adequately protect off-site areas from future releases."

DOCUMENTS REVIEWED

1. Memorandum to Mr. William Nelson, Public Health Advisor, from Mr. John Czapor, Chief, Site Compliance Branch, U.S. EPA Region II, re: Request for ATSDR Health Assessment for the Diamond Alkali Site, January 30, 1987.
2. Feasibility Study, IT Corporation, October 1985.
3. Responses to NJDEP's Comments on Diamond Shamrock Chemicals Company, 80 Lister Avenue Feasibility Study, IT Corporation (Project No. 501045) June 13, 1986.
4. Responses to U.S. EPA's Comments on Diamond Shamrock Chemicals Company, 80 Lister Avenue Feasibility Study, IT Corporation (Project No. 501045) June 27, 1986.

5. Kimbrough, Renate D., Henry Falk, Paul Stehr, and Fries, "Health Implications of 2,3,7,8-Tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," Center for Environmental Health, Centers for Disease Control, Atlanta, Georgia.
6. Memorandum, Dr. Lybarger, Medical Epidemiologist, CEH, CDD, SSB, to Dr. Margolis, Environmental Health Manager, Chronic Diseases Division, CEH, CDC, re: Review of 2,3,7,8-Tetrachlorodibenzodioxin (TCDD) contamination in the "Ironbound District" of Newark, New Jersey, near the Diamond Shamrock facility, 80 Lister Avenue, Newark, New Jersey, October 1, 1984.
7. Center for Environmental Health, CDC, re: "Public Health Recommendations for Diamond Shamrock Site and Vicinity, Newark, New Jersey," July 28, 1983.
8. ATSDR Site Files.

Previous Centers for Disease Control (CDC)/ ATSDR Involvement

CDC (doc.5) reported that "residential soil levels greater than 1 ppb TCDD pose a level of concern" with particular risk toward children living or playing in a residential area. CDC further stated that in commercial soil areas, "a level of concern may not necessarily be reached unless levels are several fold or more above 1 ppb." However, if concentrations are high, or if there is a possibility for movement of soil or a dust problem, remedial measures (such as paving of the area) should be considered. "If levels are very high (e.g., above 100 ppb), more extensive remedial action may have to be considered."

For this site, CDC (doc. 7) recommended more sampling to define the extent of contamination in residential yards and in the houses along Lister, Chapel, Albert, Cornelia, Joseph, Esther, and Lockwood Streets, because dioxin had been detected at up to 50 ppb in soil and dust collected in the streets. In addition, CDC recommended that the access to the railroad

tracks leading from the Diamond Shamrock Plant to the intersection of Lockwood Street be restricted, and that all repair and maintenance activities along the tracks cease. Furthermore, CDC issued a Health Advisory recommending that all fishing and recreational activities on the Passaic River should cease. CDC concluded that persons with long-term exposure to dioxin are at risk of adverse health effects and that additional sampling is necessary to determine the extent of contamination.

In August 1983, NJDEP began working with the National Institute of Occupational Safety and Health (NIOSH) to develop a comprehensive protocol to study former workers of the Diamond Alkali/Shamrock Facility who were occupationally exposed to dioxins from 1951 to 1970. The NIOSH study consists of a detailed questionnaire and a comprehensive medical examination.

SITE CONTAMINANTS

The major contaminant of concern is 2,3,7,8, Tetrachlorodibenzo-p-dioxin (TCDD). Other contaminants of concern that are present on-site include benzene, chlorobenzene isomers, trichlorophenols, and DDT. For a list of other contaminants on-site, the reader is referred to the summary data in the FS (doc. 2).

ENVIRONMENTAL PATHWAYS

Possible environmental pathways consist of the following:

1. Transport of adsorbed and dissolved chemicals by runoff into the Passaic River.
2. Chemicals contained in subsurface soils which leach into groundwater.
3. Volatile and particulate emissions from surface soils, and contaminated buildings on-site.

4. Bioaccumulation of contaminants by shellfish and other marine organisms in Passaic River.

EXPOSURE PATHWAYS

Potential exposure pathways for on-site remedial workers and area residents include the following:

1. Direct contact with contaminated soils and dusts.
2. Ingestion of contaminated soil and/or surface water in surrounding residential areas, especially by children 9 months to 5 years of age.
3. Inhalation of contaminated dusts and particulates.
4. Ingestion of fish and shellfish from the Passaic River.
5. Possible contamination of vegetables and other produce sold at the Farmers Market nearby.
6. Direct contact by remediation workers and exposure to their families through secondary contact from work clothes.

POPULATION AT RISK

The population at risk consists of two groups: employees working in adjacent industries and area residents, especially children. Residential areas are located approximately 1 quarter-mile south and southwest of LAS. The residential population within a 1-mile radius of LAS is approximately 10,000 people.

DISCUSSION

Air Sampling Results

A comprehensive assessment of particulate-associated dioxins emission and transport was not conducted on-site. Ambient air was sampled from the top

of the on-site office/laboratory building. Of the 31 air particulate samples, 10 were analyzed for dioxins under the guidance of NJDEP. Results of air sampling performed during "heavy" site activity detected TCDD in 2 of the 10 samples analyzed. The concentrations measured 86 and 286 picograms per cubic meter (pg/m^3). We cannot comment as to whether these values represent a potential public health threat to nearby workers or area residents. Although ingestion of dioxins-entrained fugitive dusts is considered an exposure pathway, dioxin compounds generally are not subject to volatilization because of their low volatility and the strong adsorptive capacity to soils.

Wipe and Chip Sample Results from On-site Buildings and Standing Structures

Sampling analyses confirmed the presence of TCDD on the interior and exterior of all the on-site structures. TCDD concentrations were higher on the interior surfaces of the standing structures. Reported TCDD results are summarized below.

<u>Location</u>	<u>No. of samples with TCDD present</u>	<u>Concentration</u>	<u>Sample Type</u>
Process bldg	29 of 29	41,600 ng/m^2 1,580 ppb	wipe chip
Chemical Manufacturing	27 of 28	233 - 7,000 ng/m^2 0.93 - 1,280 ppb	wipe chip
Lab Office	31 of 38	ND to 14,000 ng/m^2 ND to 69.3 ppb	wipe chip

Wipe samples obtained from the roof parapet demonstrated TCDD concentrations of 168 ng/m². Furthermore, a wipe sample taken inside the laboratory fume hood inside the building contained 14,090 ng/m² of TCDD; the laboratory fume hood exhaust is located on the roof. The potential for air updrafts created by opening and closing doors in the building during remedial site activities, or from broken windows from vandalism, is likely to release TCDD-containing particulates from the fume hood into the outside environment, perhaps creating an unnecessary public health risk to nearby workers at adjacent industries and area residents. The wipe samples give some indication of accumulation of air-carried dioxins at these locations but are not representative of TCDD exposure levels in any of the media of concern.

The potential for TCDD particulate erosion from outside building surfaces and structures and subsequent transportation by the wind to the above-mentioned off-site areas can occur. Also, future demolition of existing buildings and other standing structures on-site would greatly increase the potential for continued dispersion of TCDD.

Soil Sampling Results

The subsurface profile on-site consists of 6 to 15 feet of fill overlying a layer of silt 3 to 9 feet which is underlain by glaciofluvial sands. The fill contains dioxins in areas where herbicide manufacturing took place. TCDD levels decrease with depth. TCDD has been detected in the silt layer but has not been detected in the glaciofluvial sands. The following table reports the results of 35 of 39 soil boring samples analyzed for TCDD.

<u>Depth (inches)</u>	<u>Concentration (ppb)</u>
0 - 6	19.7 - 2,700
6 - 12	7.5 - 3,510
12 - 24	4.7 - 830

TCDD tends to adhere to organic soils and has limited migration potential. The site, except for the buildings and structures, is covered by a black geotextile fabric, further minimizing any direct contact with contaminated soil.

Groundwater Sampling Results

Groundwater generally flows in a southerly direction (away from the Passiac River). Monitoring well data from both fill and glaciofluvial sands have detected dioxin. However, the rate of migration of TCDD would be expected to be slow due to strong soil adsorption.

Out of 17 well water samples, 15 detected TCDD at concentrations ranging from 0.0059 to 10.4 ppb. The TCDD concentrations (0.03 to 10.4 ppb) were highest along the north end of the site adjacent to the river and near the process and chemical manufacturing buildings. Monitoring wells located at the south and southwestern portions of the site consistently had the lowest TCDD concentrations (ND to 0.16 ppb). The TCDD concentrations found in groundwater may be due to the presence of suspended solids in the samples, since TCDD is not very soluble in water. Inadequate information was presented to assess whether there is any current or potential human exposure to the groundwater. Further validation of sample data is needed to confirm TCDD concentrations in groundwater.

Other than TCDD, contaminants (chlorinated phenols, 4,4' DDT, 2,4-D and 2,4,5-T) detected were associated with the manufacturing process that existed on the site. Chemicals detected from groundwater analyses include:

<u>Compound</u>	<u>Range (ppb)</u>	<u>No. Samples compound detected</u>
Benzene	ND to 1200	6 of 7
Chlorobenzene	4 to 9100	7 of 7
Methylene Chloride	40 to 4100	7 of 7
Toluene	ND to 850	2 of 7
Acetone	ND to 550	1 of 7
2,4,6-Trichlorophenol	ND to 1500	1 of 7

<u>Compound</u>	<u>Range (ppb)</u>	<u>No. Samples compound detected</u>
2-Chlorophenol	ND to 160	2 of 7
2,4-Dichlorophenol	ND to 7200	1 of 7
Phenol	ND to 290	1 of 7
2,4,5-Trichlorophenol	ND to 1500	1 of 7
1,2,4-Trichlorobenzene	ND to 12	1 of 7
1,2-Dichlorobenzene	ND to 1300	4 of 7
1,3-Dichlorobenzene	ND to 64	1 of 7
1,4-Dichlorobenzene	ND to 4700	5 of 7
Bis(2-ethylhexyl) phthalate	ND to 8	2 of 7
Di-N-Octylphthalate	ND to 25	1 of 7
Aniline	ND to 18000	3 of 7
2-Methylnapthalene	ND to 2	1 of 7
4,4'-DDT	ND to 17	1 of 7
4,4'-DDD	ND to 12	3 of 7
Alpha-BHC	ND to 8	1 of 7
Beta-BHC	ND to 2	1 of 7
Delta-BHC	ND to 5	2 of 7
Dalapon	ND to 8	3 of 7
Dicamba	ND to 1	3 of 7
MGPP	ND to 1000	1 of 7
MCPA	ND to 1000	1 of 7
Dichloroprop	ND to 2	1 of 7
2,4-D	ND to 613	5 of 7
2,4,5-T	ND to 123	3 of 7
2,4-DB	ND to 4	1 of 7

The FS states that "there is no indication in the records of the NJDEP that any well in the vicinity of the site is used for drinking water." However, no mention in the reviewed materials was made about whether groundwater is used as a source of bathing, showering, and washing by either industrial employees and/or nearby residents. The levels of contaminants in the groundwater would pose a significant public health threat from ingestion. Furthermore, this environmental pathway (based on the concentrations of benzene, chlorobenzene, and TCDD) is a possible source of human exposure through direct contact.

The FS reported that low levels of TCDD were found in the Passaic River but significant levels were observed in the sediments. The actual concentrations were not reported in the FS and were not provided to ATSDR with the enclosed materials. The Passaic River is not used as a source of drinking water to area residents.

Possible Ingestion of fish and shellfish from the Passaic River

Fish flesh and shellfish sampling data from the Passaic River were not included for review. This information is addressed in another study conducted by the Potentially Responsible Party (PRP). NJDEP has banned fishing in the Passaic River. In addition, a prohibition on the sale and consumption of all fish and shellfish from the area between Dundee Dam and Newark Bay has been in effect since 1983. Currently, there is no known commercial fishing in Newark Bay.

Feasibility Study Alternatives

The Alternatives discussed in the FS include the following:

Alternative 1: No Action Alternative.

Alternative 2: Demolition of structures, decontamination, grading, and in situ containment of all waste with a slurry wall and cap.

Alternative 3: Demolition of structures, decontamination, grading, and in situ containment of all waste with a slurry wall and cap, with continued pumping and treatment of the groundwater.

Alternative 4: Demolition of structures, decontamination, grading, excavation, on-site treatment of groundwater, and thermal treatment of all site waste and soils containing dioxin above 7 ppb with in situ containment of the remaining site soils and treated material with a slurry wall and cap.

Alternative 5: Demolition of structures, decontamination, grading, excavation, on-site treatment of groundwater, and vault encapsulation of all site waste and soils containing dioxin above 7 ppb with in situ containment of the remaining site soils with a slurry wall and the vault.

Alternative 6: Demolition of structures, decontamination, grading, excavation, on-site treatment of groundwater, and hauling of waste and

soils containing dioxin above 7 ppb to an off-site facility for landfill disposal or thermal treatment; soils remaining with dioxin levels below 7 ppb would be contained by a slurry wall.

POTENTIAL PUBLIC HEALTH CONSIDERATIONS NOT ADDRESSED IN THE FS

Alternative 1 would not be acceptable in regard to preventing a public health threat to area residents and nearby workers. However, ATSDR is unable to comment on the public health considerations regarding alternatives 2 through 6 because necessary information was not provided for review. Before ATSDR can make a public health determination on Alternatives 2 through 6, the following information is needed:

1. More information regarding the risk of exposure to nearby workers and area residents during implementation of the remedial alternatives discussed above, with consideration given towards the possible evacuation of area workers and residents during remediation of on-site contaminants.
2. A contingency plan to handle fugitive dusts and volatile compounds and odors during further remedial activity.
3. A contingency plan to handle decontamination of structural steel and steel tanks, vessels, reactors, etc., if they are to be reused in the future.
4. A demonstration that the technology available for remediation at LAS is able to minimize the dispersion of contaminants off-site and preparation of a contingency plan in case of possible malfunctions.
5. An assessment of transportation risks in the alternatives dealing with off-site disposal of contaminants.

CONCLUSIONS

On-site, and possibly off-site, soil TCDD concentrations pose a significant public health threat to workers involved in remedial site activities (and possibly nearby workers and area residents) and direct contact should not occur. Groundwater beneath the site poses a potential public health threat to users; use of the groundwater for drinking, bathing, showering, washing, and cooking should not be permitted.

The FS does not sufficiently address the current or potential human health hazards from existing contamination in residential areas surrounding the site. ATSDR is unable to comment on the remedial alternatives without the necessary information discussed under section "Potential Public Health Considerations Not Addressed in the FS" above. Unless such factors are considered, the possible public health ramifications to nearby workers and area residents during on-site remediation may be significant.

RECOMMENDATIONS

1. Determine whether wells in the vicinity of the site are used for drinking, bathing, showering, washing, and cooking.
2. Assess levels of and human exposure to contaminants of site origin in surrounding residential areas. Formulate remedial plans to address all human health risks uncovered in this additional investigation.
3. Maintain the NJDEP ban on fishing in the Passaic River and the sale of fish and shellfish from area between Dundee Dam and Newark Bay.
4. Provide fish flesh and shellfish sampling data to ATSDR for review.
5. Maintain the CDC Health Advisory regarding banning recreation activities in the Passiac River.

6. Provide information regarding sediment concentrations of TCDD in the Passiac River.
7. Provide further information concerning the risk of exposure to nearby workers and area residents for each remedial alternative where inhalation and/or ingestion of reentrained TCDD-laden dust could be a problem.
8. ATSDR should review the site safety plan to insure that contingency plans regarding the containment of fugitive dusts and volatiles and the decontamination by-products from structures during remediation efforts are adequately addressed. Further site characterization should consider the following:
 - a. Train workers performing on-site activities in proper health and safety measures. These measures should be updated and reevaluated on a regular basis.
 - b. Insure proper medical surveillance of on-site remediation workers and security guards in accordance with with OSHA standards and NIOSH guidelines.
 - c. Industrial Hygiene sampling during worker activities.
9. Perform all demolition operations in accordance with OSHA regulations.



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