

# Health Assessment for

LONE PINE LANDFILL NATIONAL PRIORITIES LIST (NPL) SITE

FREEHOLD, MONMOUTH COUNTY, NEW JERSEY

CERCLIS No. NJD980505424

Agency for Toxic Substances and Disease Registry  
U.S. Public Health Service

APR 18 1989

## SUMMARY

The Lone Pine Landfill NPL (National Priorities List) site is in Monmouth County, New Jersey. The facility operated from 1959 to 1979 and received chemical, municipal, and septage wastes. The principal contaminants determined by monitoring are volatile organic compounds and metals. The site area is not extensively developed. There are about a half-dozen residences in the vicinity--the closest is about a quarter of a mile to the north, across the Manasquan River. A wildlife management area is located southeast of the site. Also, a large municipal reservoir to be constructed off-channel, 16 miles downriver from the site, will be supplied with water from the river.

The site is of potential health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse health effects. Contaminants, principally volatile organic compounds, have been detected at levels of potential concern in groundwater on-site and immediately off-site, in soils on-site, in the air at the site perimeter under certain atmospheric conditions, and in surface water in the river. Groundwater is the principal medium of concern because it is the source of potable water in the area. Surface water is also of concern because of the water supply reservoir that will draw water from the river downstream.

## BACKGROUND

### A. SITE DESCRIPTION

The Lone Pine Landfill NPL site is located on Burke Road, in Freehold, Monmouth County, New Jersey. The facility operated from 1959 until 1979 when it was ordered closed by the New Jersey Department of Environmental Protection (NJDEP). The landfill accepted over 17,000 drums containing chemical wastes along with municipal refuse, large volumes of septage, and millions of gallons of bulk liquid chemical wastes. The types and volumes of specific wastes are not known. For purposes of this Health Assessment, the landfill is considered to be the site (on-site). Areas beyond the edge of the landfill are considered to be off-site.

The landfill site is a flat-topped mound, approximately 50 acres in size, that has an average height of 40 to 50 feet above the natural grade. The northern toe of the landfill slope lies approximately 400 feet south of the main headwaters stream of the Manasquan River. A number of depressions (ponds) that retain groundwater are at the eastern edge of the landfill. A borrow pit, across Burke Road, that was used as a source of fill has some surface debris and a few above-ground, discarded storage drums. Fences and gates partially restrict access to the landfill and borrow pit, but neither area is fully enclosed by a security fence. A

large wetland area near the west edge of the landfill drains northward to the river. Groundwater provides water for the river. The Turkey Swamp Fish and Wildlife Management Area is located about 1000 feet to the east, as is a local sportsman club (i.e., Fin, Fur, and Feather Club).

The U. S. Environmental Protection Agency (EPA) issued a Record of Decision (ROD) on September 28, 1984, that describes remediation actions selected for implementation. NJDEP has indicated its concurrence with the proposal. The remediation is expected to begin in 1989 and includes the following source-control measures:

- \* Enclose the landfill with a groundwater cutoff wall that penetrates through the shallow Vincentown Formation and terminates in an underlying low-permeability zone (Hornerstown Formation).
- \* Install a multi-layer soil cover with vents that will reduce rainfall infiltration and facilitate gas release from the underlying wastes.
- \* Install and operate a groundwater removal well system within the area enclosed by the cutoff wall that will produce a net upward gradient and diminish groundwater transport of contaminants through the Hornerstown into the main water-bearing Red Bank aquifer.
- \* Treat the groundwater removed and discharge it either to the Manasquan or Metedeconk River or to the Ocean County wastewater treatment system.
- \* Remove drums and debris at the adjacent borrow pit.
- \* Enclose the operational area with a fence to restrict unauthorized entry.

The ROD also provides for more extensive groundwater monitoring off-site to determine whether the contaminant plume needs to be remediated. These evaluations are underway, and a separate ROD addressing the plume will be issued in 1989.

#### B . SITE VISIT

ATSDR (Agency for Toxic Substances and Disease Registry) has not made a site visit to date.

### ENVIRONMENTAL CONTAMINATION AND PHYSICAL HAZARDS

#### A. ON-SITE CONTAMINATION

Monitoring data have been developed for some of the waste materials (from excavated drums) and from the soils and groundwater within the landfill area. The data indicate that volatile organic compounds (VOC's) and heavy metals are contained in the wastes and have been released to environmental media. A summary of contaminant concentrations that are of principal concern is presented in Table 1, in the Appendices.

## B. OFF-SITE CONTAMINATION

Off-site monitoring data indicate that contaminants at the landfill have migrated to groundwater, surface water, sediment, and air. Examination of the monitoring information summarized in Tables 1 and 2 shows that on-site and off-site monitoring have been conducted for the groundwater media. Comparison of these data indicates that a few more contaminants were detected off-site than on-site and that the concentrations of specific contaminants were sometimes greater off-site than on-site.

## C. PHYSICAL HAZARDS

Any landfill which contains organic-bearing wastes may generate methane which has the potential to explode if it accumulates in an enclosure, such as beneath a landfill cap or in buildings. There are no methane monitoring data with which to fully evaluate this concern. However, the proposed slurry wall enclosure should restrict lateral gas migration and a venting system should direct its release to the atmosphere.

## DEMOGRAPHICS

The area around the site is sparsely populated. The nearest residences are approximately one-quarter to one-half mile to the north, beyond the Manasquan River. Land around the landfill is essentially all forested. There are no nearby agricultural activities. A wildlife management area and a local sportsman club are located about 1000 feet to the southeast of the site. A 700-acre municipal water-supply reservoir is to be constructed about 16 miles downriver from the property. Potable water in the site area is obtained from groundwater resources.

The issues affecting public health and conclusions described in subsequent sections are based upon the demography and land use outlined above. Should demography and land use become substantively different from that which are described in this document, the health issues and conclusions would need to be reconsidered.

## EVALUATION

### A. SITE CHARACTERIZATION (DATA NEEDS AND EVALUATION)

#### 1. Environmental Media

Investigation data gathered for site characterization have been fairly extensive. However, additional information is necessary to clarify a number of issues that may be potential health concerns. Monitoring of river water quality is needed at the location where the off-channel public water supply reservoir will draw water to determine if there are site-related contaminants at levels that pose a human health concern.

Periodic monitoring of water supply wells near the site is needed to determine if any contaminants have migrated at levels that pose a health concern. Monitoring data are needed adjacent to the site (e.g., surface soils, ponds, drainages, wetlands, feeder streams) to determine if contaminants have migrated there at levels which could be a health concern to persons who may enter the area. Surface soils at the debris/drum area in the borrow pit also need to be monitored because of a similar concern. There is a potential for airborne contaminants to be released during remediation construction activities and for gasses to be released through breaks in the proposed soil cover or by an air stripper, if used to treat groundwater. Therefore, real-time air quality monitoring under varying meteorological conditions is needed to determine whether releases occur at concentrations that pose a health concern to workers on-site, to persons adjacent to the site (e.g., bikers, hunters), and to nearby residents. Monitoring data are needed in nearby residences to determine if methane and contaminant gasses have migrated there and accumulated at levels for which explosion might occur or human exposure might be a health concern. Since there are fishing and hunting activities in the area, fish and game tissue monitoring may be needed to determine whether consumption may result in exposure to contaminants at levels that pose a health concern.

## 2. Demographics and Land Use

Background information regarding demographics and land use provided in reference documents are satisfactory for developing this Health Assessment.

## 3. Quality Assurance and Quality Control

ATSDR assumes that the analytical data provided by EPA have been reviewed by them and have met their acceptability criteria. The conclusions in this Health Assessment were based on the information received. The accuracy of these conclusions is determined by the availability and reliability of the supplied information.

### B. ENVIRONMENTAL PATHWAYS

Contaminants associated with the wastes that have been disposed at the site have been shown by monitoring to have migrated into the soils, to the groundwater, and to surface water and sediment. Based on information in referenced documents, it is reasonable to conclude that the organic compounds detected through off-site monitoring have migrated from the landfill to the sampling locations. For the metals, it is possible that some portion of the concentrations off-site might be an expression of background levels rather than a result of migration.

Wind currents crossing the existing site surface may periodically entrain volatile compounds and also contaminants sorbed to particles and transport them elsewhere on-site. Some of these airborne contaminants are likely to have migrated to adjacent off-site soils, ponds, wetlands, and drainage

areas. However, reference documents provide insufficient information to confirm whether or not contaminant levels of importance are present there. The proposed landfill cover and vegetation should minimize particulate entrainment and volatilization from the existing landfill surface. However, if contaminants occur at important levels in areas beyond the site perimeter, some migration by air may also originate there until, or unless, remediation is conducted for the affected area(s). The specific compounds and concentrations that might be released cannot be fully determined from the information presently available. The cover system described in the ROD does not provide for collection and treatment of VOC's; therefore, it appears that gasses, including methane, could penetrate the cover and be released to the atmosphere (e.g., through breaks created by gas pressure or other processes). If it is decided to treat groundwater on-site, rather than discharge it to the municipal wastewater system, some treatment methods (e.g., air stripping) have the potential for discharging contaminants to the air. The specific concentrations of airborne contaminants that might be released through the cap or by an air stripper cannot be defined at this time and would depend on the types and concentrations of gaseous contaminants, the integrity of the landfill cap over time, and the efficiency of the treatment system. Although some lateral movement of gases is possibly occurring now below ground surface through the shallow permeable soil zone; development of the containment wall around the landfill should effectively restrict this migration.

Airborne contaminant migration also may be occurring from debris and barrels at the borrow pit. The proposed removal of these materials should effectively mitigate migration from these sources. However, surface soils potentially contaminated from these sources may provide an additional source of airborne contaminants. However, there are no data to confirm soil contamination has occurred.

Landfill wastes have released contaminants that have migrated into the groundwater beneath the site. Migration typically is initiated by rainwater that seeps through the contaminated soils and wastes, but liquid wastes may migrate directly to the groundwater. Contaminant migration at the site also is induced directly by groundwater as it moves through contaminated soils and wastes that occur below the water table. Also, if the adjacent ponds contain contaminants, these may be released to the groundwater. Evaluations indicate that the hydrogeologic features of principal importance to groundwater and contaminant movement in the vicinity of the site include:

- \* Permeable soils in the Vincentown Formation Aquifer within which the landfill was developed. This zone is underlain by the Hornerstown Formation, a zone of generally low-permeability soils, that inhibits (but does not prevent) migration of contaminants to deeper aquifers. Beneath the Hornerstown are the Tinton Sand and also the Red Bank Formation which is an aquifer. The Red Bank Aquifer is underlain by

an aquitard that has a very low permeability and a higher hydraulic head than the overlying zones. These features minimize the potential for landfill contaminants to migrate to deeper aquifers.

- \* The groundwater table is encountered at shallow depth within the Vincentown Formation. The formation may pinch out near the river.
- \* Based on available information, the Manasquan River apparently serves as a hydrogeological barrier and sink for contaminated groundwater.
- \* Pollutants, some of which migrate from the Vincentown into the underlying Red Bank aquifer, have been detected in groundwater north and east of the site. The contaminants are believed to discharge to the river, in close proximity to the landfill, and not migrate beyond the river.

Water supply needs for major commercial and industrial facilities and approximately 85 percent of the township residents are met by municipal wells, the closest of which is located approximately 4 miles from the site. The nearest private wells include three upgradient residential wells, a nonresidential well approximately 1000 feet east of the landfill, and several residential wells located about 1/2 mile north of the site across the river. The contaminant plume is observed, by monitoring, to be migrating beyond the landfill to the east and north, toward the river; but investigators believe the groundwater discharges into the river and does not migrate farther north. Monitoring data along the south side of the river shows contaminated groundwater exists there, and additional monitoring is being conducted on the north side of the river. The plume also is known to extend to the east side of Burke Road; however, data from monitoring wells 800 and 1500 feet in that direction suggest that the plume has not travelled that far. Data developed in 1981 for the nearby water supply wells identified lead in 2 residential wells at an estimated concentration of 20 ppb.

Over time, the borrow area clean up, and the landfill cover, containment wall, and treatment of contaminated groundwater withdrawn from the containment area should reduce the magnitude and rate of contaminant releases. These actions also may improve groundwater quality over time. However, the specific effectiveness of the system and its overall reduction of contaminants in off-site groundwater can only be evaluated through continued groundwater monitoring. Also, if contaminants occur beyond the landfill in surface soils, ponds, drainages, wetlands, and feeder streams; these contaminants could continue to migrate to the groundwater unless, or until, remediation is implemented.

Surface water features of potential importance include ponds, drainages, wetlands, the river, and three intermittent feeder streams which discharge to the river. Wind and rainfall runoff are likely to transport surficial landfill contaminants to these surface water features, and leachate has been observed migrating off-site from the mound slopes. Monitoring data indicate that substantial levels of contamination had been detected in river water in 1980 and 1982, but concentrations since 1982 have been nominal or not detected. Information in reference documents does not

fully characterize the magnitude and extent of contamination in other surface water components. A single set of monitoring data reported for leachate from a slope of the landfill and for other selected surface water components adjacent to the site identified fewer contaminants at relatively lower concentrations than have been recorded in the river. Hence, that single sample set possibly is not representative. Evaluations also indicate that groundwater that flows beneath the site discharges to the river and, if left unchecked, would be the major source of site-related river contaminants. Within the river, contaminants are dissolved in the water and retained (sorbed) by suspended particles and sediments. After the proposed off-channel water-supply reservoir is constructed downstream of the site, there is a potential for contaminants dissolved and suspended in river water to be withdrawn and discharged into the basin. However, river water monitoring data are not available by the proposed reservoir location to determine if potentially important site-related contamination occurs there. The cover and containment wall system (and proposed borrow area removal) should substantially reduce the amount of contaminants transported by runoff, and contaminants existing around the landfill in ponds, soils, drainages, etc., should not be replenished.

The Manasquan River is stocked with trout and has other fish; therefore, fish are a potential environmental pathway (i.e., food chain) for contaminants. Wild game which may stray from the wildlife management area also are a potential pathway. However, reference documents provide no data by which to determine if fish or game tissue are contaminated.

#### C. HUMAN EXPOSURE PATHWAYS

The most important potential human exposure pathway is through groundwater which has become contaminated by site releases and is used as the potable water supply in the area. The proposed development of an off-channel water supply reservoir downstream of the site also poses a potentially important exposure pathway for contaminants released to the river, pending remediation of the site. A summary of human exposure pathways is provided in Table 3, in the Appendices.

#### PUBLIC HEALTH IMPLICATIONS

Monitoring data indicate that waste operations have released a number of organic compounds and heavy metals to environmental media through which there is a potential for exposure at concentrations that may pose a human health concern.

Contaminants have been detected in groundwater monitoring wells on-site and off-site at levels of potential human health concern through ingestion, inhalation, and direct contact. However, monitoring conducted to date in area water supply wells suggests that the contaminant plume may not have advanced to their locations. The site cover, containment wall,

and associated groundwater pumping should substantially reduce contaminant levels in the groundwater over time. If effective, these measures should abate the risk to human health. If substantial concentrations of contaminants have migrated to areas adjacent to the landfill; these contaminants could continue to adversely affect groundwater quality and subsequently human health, through its consumption, unless remediation of these areas, not currently proposed in the ROD, is implemented.

Off-site monitoring well data indicate numerous organic compounds and some metals are present in groundwater. Some of the compounds and elements occur at maximum concentrations that would be of concern to human health with long-term, and some cases short-term, exposures if the contaminants were to reach water supply wells at these levels or if new water supply wells were to be installed within the contaminated zone. These include benzene [1,939 ppb (parts per billion)], tetrachloroethene (76 ppb), arsenic (53 ppb), toluene (18,000 ppb), 1,2-dichloroethane (4,700 ppb), chlorobenzene (130 ppb), trichloroethene (6,700 ppb), lead (4,800 ppb), 1,2-dichloroethene (2,128 ppb), 1,1-dichloroethene (98 ppb), vinyl chloride (334 ppb), ethylbenzene (3,325 ppm), cadmium (770 ppb), and chromium (1,900 ppb). These concentrations exceed EPA's Proposed Maximum Contaminant Levels (PMCL's) and/or Maximum Contaminant Levels (MCL's) for drinking water. The concentrations of 1,2-dichloroethene, ethylbenzene, and toluene exceed EPA's 10-day Health Advisory values for drinking water while the concentrations of benzene, 1,2-dichloroethane, and chromium exceed EPA's 1-day Health Advisory.

These contaminants can be absorbed orally. Benzene also will readily volatilize from aqueous media and is well absorbed by the inhalation route. Benzene is a known human carcinogen and is considered to be carcinogenic by all routes of exposure. Benzene also induces a variety of noncarcinogenic, hematologic toxicities following both acute and low-level, chronic exposure. Acute exposure to 1,2-dichloroethane results in central nervous system depression. Animals administered lethal doses of 1,2-dichloroethane usually die as a result of renal damage or cardiovascular collapse. It has been noted that low-level, chronic exposure to 1,2-dichloroethane has caused liver and kidney damage. EPA classifies 1,2-dichloroethane as a probable human carcinogen. Tetrachloroethene may cause central nervous system depression and hepatic injury and is also a probable human carcinogen (EPA classification). Trichloroethene is readily volatilized, is well absorbed by all exposure routes, and is a probable human carcinogen (EPA classification) and hepatic toxicant following long-term oral or inhalation exposure. Acute and chronic inhalation of 1,2-dichloroethene may cause liver degeneration, and 1,1-dichloroethene is a possible human carcinogen (EPA classification). Vinyl chloride is a human carcinogen and may cause nervous system depression and hepatic damage. Chlorobenzene is toxic to the respiratory and central nervous systems and liver. Acute and chronic inhalation of ethylbenzene may adversely affect pulmonary function, and ingestion can cause kidney and liver disease. Acute exposure to toluene predominantly results in central nervous system depression. Acute and

chronic exposure to toluene may result in liver and kidney effects. Arsenic is a human carcinogen through oral exposure. Chronic oral lead exposure induces neurological, hematological, and renal toxicities, with the neonate and young being particularly sensitive to the neurological effects of chronic exposure. These concerns for lead have caused EPA to consider the advisability of reducing its threshold level of concern for lead in drinking water to 5 ppb. Chronic oral cadmium exposure can induce renal toxicity, manifest as tubular proteinuria with secondary osteoporosis; and oral chromium exposure can induce liver and kidney toxicity, and may be irritating to the gastrointestinal tract.

Groundwater monitoring information indicate that the contaminant plume may not have reached the local groundwater supply wells. None of the data indicates the presence of any contaminant that exceeds drinking water standards. Lead was detected in two wells at estimated concentrations of 20 ppb, which is greater than the PMCL (5 ppm) being considered by EPA; but the data are not conclusive (i.e., estimated levels). Additional monitoring at these two wells would be needed to confirm whether lead is present at a level of concern.

Groundwater contamination will continue to pose a potential human health concern unless, or until, its quality is improved through the site remediation and continuing migration of residual groundwater contaminants to the river. EPA will continue to evaluate the groundwater plume and will decide at a later date whether or not to pump and treat the contaminated water.

Site intruders or remedial workers, if unprotected, may be exposed through ingestion, dermal contact, and inhalation to contaminated wastes and soils on-site at levels that pose a health concern. Monitoring data indicate these may include essentially all the contaminants previously discussed for groundwater. The proposed cover should substantially reduce the potential for intruder exposure to surface soil and waste contaminants at the landfill. However, there also appears to be a potential for human exposure to site-related contaminants in soils, surface water, and sediments on the site periphery in woodlands, drainages, ponds, wetlands, and feeder streams. No definite health implication can be determined regarding these areas because monitoring data are not available in the reference documents.

The river is used for fishing, and there are likely to be recreational activities (i.e., swimming, wading), as well. Users may be exposed through ingestion, inhalation, or dermal contact to contaminants in surface water, and possibly in some of the sediments, at levels that pose a human health concern. Monitoring data developed for the river at locations by the site indicate the contaminants of concern include essentially all those previously discussed in relation to groundwater, although concentrations in the surface water are generally much less. River water data are not provided for the reach where the off-channel reservoir will be developed. A few of the contaminants detected in the

river are sufficiently persistent that they may migrate a considerable distance. However, without monitoring data, it is not possible to evaluate whether or not the resultant contaminant concentrations withdrawn into the reservoir might adversely affect health. It is possible that contaminant releases from other sources in the watershed also could contribute to impact water quality at the reservoir location. The site cover and below-ground containment wall should substantially reduce release of contaminants to the river via runoff and groundwater. As previously stated, however, contaminants that may exist adjacent to the site in soils, surface water and sediment may be continuing sources of contaminants to the river. Also, if the treated groundwater is released to the river rather than to the municipal treatment system, the discharge will include residual contaminants at concentrations not yet specified.

Intruders and unprotected remedial workers may inhale and ingest airborne contaminants originating with the disposed wastes and contaminated soils. Ambient air monitoring conducted adjacent to the site detected a few VOC's. Of these, benzene (25 ppb), trichloroethene (15 ppb), and ethylbenzene (32 ppb) would pose a health concern for long-term exposure at the levels recorded. Nearby residents might now be exposed to the airborne contaminants, and exposure also might continue after site remediation from gasses that could be released through cracks in the landfill cover or from an air stripper, if that is used to treat groundwater. Methane also poses a potential threat of physical injury because it can be explosive if it accumulates at critical concentrations. It is possible that methane and contaminant gasses might migrate laterally below ground to the nearest residences on the south side of the river; but, after installation of the containment wall, the potential for lateral migration should be essentially eliminated, thereby reducing or eliminating the threat of physical injury and health concerns.

Consumption of fish from the river or game from the wildlife management area across Burke Road provides a potential exposure pathway for contaminants released from the site. However there is no information to indicate if contaminants occur in fish or in game at levels that pose a human health concern.

## CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

This site is of potential health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse health effects. As noted in the Human Exposure Pathways section above, human exposure to a number of contaminants may be occurring. The contaminants of concern are principally volatile organic compounds and a few heavy metals.

Area residents rely on groundwater for potable and household use and potentially are exposed to contaminants via ingestion, dermal contact, and inhalation. Contaminants have been found in off-site groundwater monitoring wells at levels that pose an acute health concern. However, to date, it appears that the contaminant plume may discharge fully to the Manasquan and, hence, not advance to the water supply well locations. Monitoring data have given inconclusive information about lead (e.g., estimated 20 ppb) at two of the residential wells.

Intruders and future remedial workers (if not adequately protected) may be exposed to contaminants in on-site soil and waste through ingestion, dermal contact, and inhalation at levels that pose a concern for human health. If substantial concentrations of contaminants have migrated to soils, surface water, and sediments in areas adjacent to the site; persons entering these areas may be exposed by ingestion, dermal contact, and inhalation. Much of the monitoring data needed to evaluate potential health concerns for these areas are unavailable.

Intruders and, possibly, nearby residents, might be exposed to airborne contaminants at levels of health concern, depending on the contaminant concentrations released from the landfill cover or from equipment treating groundwater. Ambient air monitoring data at residences are not available; hence, potential health concerns for these parties cannot be evaluated. Physical injury and health concerns may occur if methane and gasses migrate laterally below ground and collect within nearby residences, but monitoring data are not available to evaluate this issue. The potential for migration to residences and for associated injury or health concerns should be essentially eliminated sometime after the remedial subsurface containment wall is in place and lateral releases diminish.

Persons who use the river for recreation or fishing may be exposed to contaminants in surface water by ingestion, dermal contact, and inhalation. After the proposed off-channel public water supply reservoir is in use downriver, surface water contamination in the river poses a possible health concern to the public water users.

The proposed remediation plays a major role in protecting and minimizing public health concerns. Important elements include the site cover and containment wall for source control and EPA's continuing evaluations concerning rehabilitation of contaminated off-site groundwater (will be the subject of a future ROD). The criteria for determining if off-site groundwater rehabilitation will be conducted are not described in the current ROD, nor are the criteria that would be used for treatment of groundwater withdrawn from the containment prior to its discharge into the river. Therefore, specific conclusions regarding the effectiveness of these measures for protecting health cannot be developed. Remediation activities may result in migration of airborne particulate and volatile contaminants to nearby residences. The volatile compounds may include releases from an air stripper, if used, and releases from the landfill through breaks that may form in the soil cap. The program also is not

actively addressing the potential for contaminants to be present at levels of concern to human health in the borrow pit surface soils or in surface soils, ponds, drainages, wetlands, and feeder streams adjacent to the landfill.

## B. RECOMMENDATIONS

1. In accordance with CERCLA as amended, the Lone Pine Landfill NPL Site, Freehold, NJ has been evaluated for appropriate follow-up with respect to health effects studies. Inasmuch as there is no extant documentation or indication in the information and data reviewed for this Health Assessment that human exposure to on-site and off-site contaminants is currently occurring or has occurred in the past, this site is not being considered for follow-up health studies at this time. However, if data become available suggesting that human exposure to significant levels of hazardous substances is currently occurring or has occurred in the past, ATSDR will reevaluate this site for any indicated follow-up.
2. ATSDR concurs with EPA's intention to continue monitoring off-site groundwater and to evaluate the need to remediate the groundwater contaminant plume. It also would be appropriate to periodically monitor nearby water supply wells and to effect a remediation for those users if contaminants are detected at levels of health concern. At any water supply wells where data are found to be inconclusive, supplemental monitoring should be conducted.
3. It would be appropriate to implement measures that would prevent installation or use of any water supply well at locations where groundwater contamination has been indicated at levels of health concern.
4. Important levels of contaminants occasionally have been detected in the river by the site, and some of these are sufficiently persistent (e.g., vinyl chloride, metals) to potentially migrate considerable distances in the water. Therefore, water quality monitoring should be continued in the river, and should include data obtained by the off-channel reservoir to determine if site-related contaminants occur at levels that pose public health concerns.
5. Monitoring data are needed adjacent to the landfill (e.g., surface soils, ponds, drainages, wetlands, feeder streams) to determine if contaminants have migrated there at levels for which exposure at those locations might be a concern to public health. Monitoring information is needed for surface soils at the borrow pit debris/drum area for the same purpose.
6. ATSDR concurs with EPA's intention to provide a means to prevent unauthorized entry onto the landfill area.

7. Conduct real-time air quality monitoring during varying meteorological conditions to determine if persons on-site or off-site are exposed to unacceptable levels of airborne contaminants that may result from cover and containment wall construction or releases through the cover vents after construction. Provide for collection and treatment of vent gasses, if warranted.
8. Monitor fish and game tissues to determine if consumers may be exposed to contaminants at levels that pose a health concern.
9. If treated groundwater is discharged to the river, water quality monitoring of the discharge is needed to determine if there are contaminants at levels for which human exposure might be a health concern.
10. Require remedial workers to adhere to applicable regulations and recommendations outlined by the Occupational Safety and Health Administration and National Institute for Occupational Safety and Health to ensure that these workers are not exposed to unacceptable levels of site contaminants.

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#### REFERENCES

1. USEPA, 1984, Record of Decision, Lone Pine Landfill Site
2. USEPA, 1985, Draft, Final Report, Feasibility Study, Lone Pine Landfill Site
3. S. S. Papadopoulos & Associates, 1987, Draft, Supplemental Remedial Investigation, Lone Pine Landfill

APPENDICES

- Table 1 On-Site Contaminants of Potential Concern
- Table 2 Off-Site Contaminants of Potential Concern
- Table 3 Human Exposure Pathways

TABLE 1  
ON-SITE CONTAMINANTS OF POTENTIAL CONCERN  
Maximum Detected Concentrations  
(in ppb unless otherwise indicated)

<u>Compound</u>	<u>Ground Water</u>	<u>Soil</u>	<u>Wastes in Excavated Drums</u>
Benzene	4,700	2,900	150,000
Chlorobenzene	4,400	4,100	4,800
1,2-Dichloroethane	ND	ND	38,000
1,1-Dichloroethene	ND	6	180
1,2-Dichloroethene	ND	ND	8,300
Ethylbenzene	1,200	25,000	3,400 (ppm)
Tetrachloroethene	ND	12,000	410 (ppm)
Toluene	1,200	80,000	5,900 (ppm)
Trichloroethene	17	24,000	19,000
Vinyl Chloride	4 (a)	ND	NI
Cadmium	ND	NI	140 (ppm)
Chromium	83	NI	1,600 (ppm)
Lead	ND	NI	8,900 (ppm)
Arsenic	325	NI	230 (ppm)

TABLE 2  
OFF-SITE CONTAMINANTS OF POTENTIAL CONCERN  
Maximum Detected Concentrations (ppb)

<u>Compound</u>	<u>Ground</u>		<u>Surface Water</u>		<u>River</u>	<u>Residential</u>
	<u>Water</u>	<u>Air (c)</u>	<u>River</u>	<u>Other (b)</u>	<u>Sediment</u>	<u>Wells</u>
Benzene	1,939	25	25 *	8	31	(d)
Chlorobenzene	130	ND	140	ND	<2.5	
1,2-Dichloroethane	4,700	ND	120	ND	ND	
1,1-Dichloroethene	98	ND	23	ND	ND	
1,2-Dichloroethene	2,128	ND	29 *	ND	ND	
Ethylbenzene	3,325	32	200 *	4 (a)	140	
Tetrachloroethene	76	ND	32	ND	ND	
Toluene	18,000	183	26 *	5	ND	
Trichloroethene	6,700	15	28	ND	ND	
Vinyl Chloride	334	ND	440	ND	ND	
Cadmium	770	ND	12	ND	NI **	
Chromium	1,900	ND	ND	43	NI **	
Lead	4,800	ND	49	ND	NI **	
Arsenic	53	ND	ND	200	NI **	

ND - not detected

NA - no analysis

NI - no data in reference documents

a - estimated value

b - sampling points included seeps and drainage features located between landfill and river

c - monitored at edge of landfill; total six samples, taken on two consecutive days

d - reference documents indicate 1981 monitoring showed no contaminants exceed drinking water standards. Lead was estimated to be 20 ppb in two wells.

\* - reference documents also include other data with an unexplained qualifier—"sample analysis using a dilution"—that are an order of magnitude greater than the values given in this table.

\*\* - The ROD indicates that "low levels...have...been detected..."

TABLE 3

## HUMAN EXPOSURE PATHWAYS

MEDIA	POTENTIAL EXPOSURE POINTS	POTENTIAL EXPOSURE ROUTES OF CONCERN [Y/N] <sup>E</sup>
SOIL	<p><u>ON-SITE</u> * Intruders onto property possibly exposed. Proposed capping measures should reduce potential for future exposure. * Remedial workers, if unprotected, possibly exposed.</p>	<p>Y * Ingestion, dermal contact.  Y * Ingestion, dermal contact.</p>
	<p><u>OFF-SITE</u> * Persons entering areas immediately surrounding landfill possibly are exposed to contaminants that may have migrated from the site to the off-site soils by air and runoff. However, monitoring has not been conducted in these areas to confirm whether soils are contaminated. Proposed capping should reduce potential for releases to off-site areas; and, with time, the organic compound concentrations and the potential for exposure may diminish.</p>	<p>Y * Ingestion, dermal contact.</p>
	<p>* Persons at nearby residence (1/4 mile) possibly are exposed to contaminants that may have migrated by air from the site to the residential property. Residence probably is too far for soil-related contaminants to have migrated at concentrations that are of concern. Therefore, exposure by this pathway is considered unlikely.</p>	<p>N * Not a likely current environmental pathway, no likely exposure routes (although future construction of homes on property closer (e.g., adjacent) to the landfill possibly would result in exposure through ingestion, dermal contact--see preceding issue.</p>
<p>* Persons entering the debris area at the borrow pit possibly are exposed to contaminants in soil or debris. However, monitoring has not been conducted to determine whether contaminants occur in these materials. Proposed clean up of debris and drums there should reduce potential for exposure, but exposure to contaminants in soil could continue.</p>	<p>Y * Ingestion, dermal contact.</p>	
GROUND WATER	<p><u>ON-SITE</u> * There are no on-site water supply wells and none are likely in the future. Therefore, no probability of exposure by this pathway.</p>	<p>N * Not a current human exposure pathway; therefore, no likely current exposure routes (future water-supply well installation unlikely).</p>

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TABLE 3  
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MEDIA	POTENTIAL EXPOSURE POINTS	POTENTIAL EXPOSURE ROUTES OF CONCERN [Y/N] <sup>E</sup>
	<p><u>OFF-SITE</u> * Persons in the vicinity use groundwater for drinking and household purposes and possibly are exposed, although monitoring to date has not confirmed if contaminants are present at levels of public health concern. With time, the proposed borrow pit and landfill remediation activities should substantially improve groundwater quality. However, contaminants that may reside beyond the landfill in surface soils, ponds, drainage systems, wetlands, and feeder streams would continue to release some contaminants to groundwater until, or unless, remediation is initiated.</p>	<p>Y * Ingestion, dermal contact, inhalation.</p>
<p>SURFACE WATER, SEDIMENT</p>	<p><u>ON-SITE</u> * There are no surface water containments on-site. Therefore, no probability of exposure by this pathway.</p>	<p>N * Not a current environmental pathway, no likely current exposure routes.</p>
	<p><u>OFF-SITE</u> * Persons entering drainage channels, feeder streams, ponds, and wetlands downgradient of the site possibly are exposed to contaminants in water and sediment. The proposed remedial activities should substantially reduce contaminants released by runoff to these areas. Over time, the concentrations of organic compounds and the potential for exposure should diminish.</p>	<p>Y * Ingestion, dermal contact, inhalation.</p>
	<p>* Persons using the river for recreation and fishing possibly are exposed. The proposed remedial activities should substantially reduce contaminants released to surface water by runoff and groundwater. Over time, concentrations of organic compounds and the potential for exposure should diminish.</p>	<p>Y * Ingestion, dermal contact, inhalation.</p>

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TABLE 3  
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MEDIA	POTENTIAL EXPOSURE POINTS	POTENTIAL EXPOSURE ROUTES OF CONCERN [Y/N] <sup>E</sup>
	<p>* After the off-channel water supply reservoir that will withdraw from the Manasquan River is operational, persons using the water supply possibly would be exposed. However, there are no data to confirm whether or not contaminants occur in the river by the reservoir site. Over time, the proposed site remediation should reduce the contaminants in the river. This, coupled with natural degradation of volatile organic compounds over the 16-mile distance, should reduce the potential for exposure through this pathway.</p>	<p>Y * Ingestion, dermal contact, inhalation.</p>
AIR	<p><u>ON-SITE</u> * Intruders possibly are exposed to airborne particulate and gaseous contaminants and methane. The proposed cover should reduce the potential for exposure to airborne particles. However, gasses may continue to be released through the cap vents. * Remedial workers, if unprotected, possibly will be exposed to particulate and volatile contaminants and methane.</p>	<p>Y * Inhalation, ingestion (contaminants). Explosion, physical injury (methane).</p>
	<p><u>OFF-SITE</u> * Persons at the nearest residence and persons entering areas adjacent to the site possibly are exposed to airborne gasses and methane, and increased exposure possibly could occur during remediation construction and from releases that might occur through the existing soil cap and from groundwater treatment if an air stripper is used. After remediation is completed, the potential for exposure would be lessened, but releases may continue through the cap vents. Exposure also may continue to occur at areas adjacent to the site, if contaminants reside there.</p>	<p>Y * Inhalation, ingestion (contaminants). Explosion, physical injury (methane).</p> <p>Y * Inhalation, ingestion</p>

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TABLE 3  
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MEDIA	POTENTIAL EXPOSURE POINTS	POTENTIAL EXPOSURE ROUTES OF CONCERN [Y/N] <sup>E</sup>
FOOD CHAIN	<u>ON-SITE</u> * No likely exposure.	N * Not a current environmental pathway, no exposure routes.
	<u>OFF-SITE</u> *Persons consuming fish taken from downgradient surface waters and wild game taken in the area may be exposed. However, there are no data to confirm whether fish and animal tissues are contaminated. Over time, proposed site remediation should reduce the potential for exposure.	Y * Ingestion.

Note<sup>E</sup>: Y = Route(s) potentially a concern  
N = Route(s) not of concern