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Public Health Assessment for

SENECA ARMY DEPOT
ROMULUS, SENECA COUNTY, NEW YORK
CERCLIS NO. NY0213820830
SEPTEMBER 29, 1999

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comment Period Ends:

NOVEMBER 15, 1999

PUBLIC HEALTH ASSESSMENT

SENECA ARMY DEPOT

ROMULUS, SENECA COUNTY, NEW YORK

CERCLIS NO. NY0213820830

Prepared by:

Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30-day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

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You May Contact ATSDR TOLL FREE at
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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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AOC	area of concern
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CREG	ATSDR's cancer risk evaluation guide
CV	ATSDR's comparison value
1,2-DCE	1,2-dichloroethylene
DWQS	New York State's drinking water quality standard
EMEG	ATSDR's environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
ESI	environmental site investigation
FLHSA	Finger Lakes Health Systems Agency
IRP	Installation Restoration Program
MCL	EPA's maximum contaminant level
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OUs	operable units
PAH	polycyclic aromatic hydrocarbon
pCi/L	picocuries per liter
PCB	polychlorinated biphenyls
PHA	public health assessment
PHAP	public health action plan
ppb	parts per billion
ppm	parts per million
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RMEG	ATSDR's reference dose media evaluation guide
SI	site investigation
SVOCs	semivolatile organic compounds
SWMU	solid waste management unit
TCE	trichloroethylene
USACE	U.S. Army Corp of Engineers
UXO	unexploded ordnance
VOCs	volatile organic compounds

SUMMARY

The Agency for Toxic Substances and Disease Registry (ATSDR) evaluated available environmental data and exposure information associated with the Seneca Army Depot Activity site, in Seneca County, New York. Based on these data, ATSDR determined that the site poses *no apparent public health hazard.* Additional data are needed, however, to more fully assess potential public health hazards, if any, associated with radiological contamination at the site.

The Seneca Army Depot Activity is located on approximately 10,600 acres near Romulus in New York's Seneca County. Since 1941, Seneca Army Depot Activity has been used primarily for the storage or maintenance of conventional strategic weapons, critical materials, and general supplies, including hazardous materials. As a result of normal operations and storage practices, chemicals have been released to the environment.

In response to concerns about chemical releases at the site, the Army has conducted various environmental investigations. Through these investigations, the Army has detected volatile organic compounds (VOCs), explosive compounds, fuels, and metals in soil and groundwater and, to a lesser extent, in on-site surface water and sediment. ATSDR reviewed the available environmental data and exposure information to determine whether contamination at the Seneca Army Depot Activity could be harmful to people who obtain access to, or live near, the depot.

Through this review, ATSDR determined that VOCs were present in groundwater beneath the Ash Landfill at levels above health guidelines. This VOC plume extends from the landfill to approximately 250 feet beyond the depot's western boundary, in the direction of several off-site farmhouse wells. The leading edge of this plume contains total VOCs, which include trichloroethylene, 1,2-dichloroethylene, and vinyl chloride, at a concentration of about 10 ppb. No past or current public health hazards are associated with this plume, however, because the contamination has not migrated to nor has it been detected in the downgradient private wells or other drinking water sources. Moreover, it is unlikely that VOC contamination will pose future public health concerns because Seneca Army Depot Activity plans to implement remedial measures to control the suspected source and limit migration of contaminated groundwater.

ATSDR also evaluated potential exposures that might occur through contact with surface soil, surface water, or sediment, and ingestion of local game (e.g., deer and fish). ATSDR concluded that any low-level chemical contamination present in soil, sediment, or surface water is unlikely to pose a public health hazard.

Because of limited available radiological data, ATSDR was unable to fully assess potential public health hazards associated with radiological contamination at the depot. The Army is currently investigating radiologic contamination at the depot. Following receipt of data from the investigation and an assessment of potential public health hazards, ATSDR will issue an addendum to this document.

BACKGROUND

Site Description and History

Seneca Army Depot Activity is a military depot located in Seneca County, New York (see Figure 1). The depot lies in an upland area that forms a divide between two Finger Lakes, Cayuga Lake to the east and Seneca Lake to the west (Figure 2). The town of Romulus is adjacent to the eastern border of the depot (Woodward-Clyde, 1997). Overall, the post occupies approximately 10,600 acres, divided into six geographic areas because of similar functional histories. These six geographic areas are further described in Table 1.

Seneca Army Depot Activity was originally established in July 1941 as the Seneca Ordnance Depot. In 1963, the Seneca Ordnance Depot was transferred to the U.S. Army Supply and Maintenance Command from the Chief of Ordnance and renamed the Seneca Army Depot. With the reduction in national military activity, the Army renamed the facility to Seneca Army Depot Activity in 1993 and discontinued soldier and National Guard training there in 1996.

The has served primarily as a maintenance and storage site for conventional weapons, strategic and critical materials, and general supplies, including hazardous materials. Typical maintenance operations included degreasing, spray painting, steam cleaning, alkaline washing, paint removal, welding, and soldering. Wastes such as used solvents from the steam cleaning facilities and from self-contained degreasing units were disposed of off site by a private contractor, while wastes (e.g., solvents, grease, metals dust, acids, propellants, and explosive dusts) generated by other operations were either burned in on-site areas such as the Open Burning Grounds or released as overflow into the storm drain system, into drainage ditches, or to the ground. Radiological wastes were stored at the depot in the 1940s, but this practice no longer occurs (Woodward-Clyde, 1997).

Almost half of the depot property (about 4,010 acres) has been used for storing ammunition, special weapons, pyrotechnics, and munitions-related items. These items were kept in one of the 455 storage igloos, 8 standard magazines, or 6 warehouses within the ammunition storage area, or within one of 64 special storage igloos in an exclusion area. The depot also housed large reserves of ores, including ferro manganese, ferro chrome, cromite ore, chromed ore, columbite ore, and pitch blended ore. Piles of chromed ore were stored either directly on the ground or on concrete pads at various locations on site, while columbite oreate (a mixture of oxides of iron, manganese, niobium, and tantalum) was stored in several on-site buildings. In the 1940s, the Army also stored pitch blended ore in 11 igloos within the ammunition storage area. Eventually, the Army removed the ore from the igloos and reused the structures for storing conventional weapons (Engineering Science, Inc., 1994).

As a result of past operations, storage, and disposal practices, hazardous materials have been released to the environment. Principal site contaminants are volatile organic compounds (VOCs), primarily trichloroethylene (TCE), 1,2-dichloroethylene (1,2-DCE), and vinyl chloride; explosive compounds; fuels; and metals. Radiological constituents are also believed to have been released to soil and to the underlying groundwater in areas where radioactive materials or wastes were stored. The U.S. Environmental Protection Agency (EPA), the primary regulatory agency overseeing environmental investigations of the depot, placed Seneca Army Depot Activity on the National Priorities List on July 13, 1989 (Engineering Science, Inc., 1994). In 1993, EPA, the Army, and the New York State Department of Environmental Conservation (NYSDEC) entered into a Federal Facility Agreement (also known as the Interagency Agreement) to integrate the Army's Resource Conservation and Recovery Act corrective actions with the requirements of EPA's Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), also known as Superfund. All required future investigations were based on CERCLA guidelines.

Through its investigation, the Army identified 72 sites or solid waste management units (SWMUs) that had or were suspected to have environmental hazards (Engineering Science, Inc., 1994; Woodward-Clyde, 1997). Of the 72 SWMUs, 25 are considered to require no further action. The remaining SWMUs were assigned priority according to hazard ranking criteria defined by the Army Center for the Environment (USACE), EPA, and NYSDEC. On the basis of the hazards ranking, 28 SWMUs (grouped into 7 areas) were slated as high priority sites where a release of hazardous wastes had been reported or a release was likely to have occurred. (Parsons Engineering Science, Inc., 1995a; Woodward-Clyde, 1997).

The Seneca Army Depot Activity further grouped the SWMUs into 13 operable units (OUs) to facilitate characterization of the sources, nature, and extent of contamination at and around the depot and to enable proper design of clean-up measures. At each OU, the Seneca Army Depot Activity has conducted or is now conducting both a remedial investigation (RI) to characterize the contamination and a feasibility study to determine the best methods of remediation. Table 2 describes each of these sites in greater detail.

The Federal Base Realignment and Closure (BRAC) Commission has approved and anticipates closure of the Seneca Army Depot Activity by July 13, 2001.[1] The goal of the BRAC is to quickly transfer excess military property to the local community for economic reuse and development. So far, approximately 8,600 acres at the Seneca Army Depot Activities site are considered suitable for transfer or lease (Woodward-Clyde, 1997). In closing the site, the Army is required to notify the appropriate regulatory agencies of any changes in proposed use of the site and to perform any additional investigations and clean-up actions to ensure that these changes are harmless to the public.

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[1] The BRAC environmental program is similar to the Department of Defense's Installation Restoration Program (IRP), but it includes non-CERCLA substances that are not normally addressed under the IRP, including asbestos materials, lead-based paint, polychlorinated biphenyls, radon, unexploded ordnance, radionuclides, and pesticides (Woodward-Clyde, 1997).

ATSDR Involvement

As part of the public health assessment process, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted a site visit and met with representatives from the Army, Seneca Army Depot Activity, and Seneca County Department of Health March 16 through 18, 1998. At the time of the site visit, ATSDR did not identify any completed exposure pathways requiring immediate action. ATSDR also communicated and met with community members who raised concerns about the environmental conditions at Seneca Army Depot Activity. These concerns are presented in the *Community Health Concern* section of this document.

Demographic and Land Use Information

The following discussion presents demographic and land use information for the area surrounding Seneca Army Depot Activity. This information helps ATSDR assess who might have been exposed to site-related contaminants and when and where such exposures might have occurred.

At the peak of its activity, Seneca Army Depot Activity was the third largest employer in Seneca County, employing more than 2,500 civilian and active duty personnel. As a result of closing the depot, the number of employees declined to approximately 85 people at the time of this PHA. . The Army will require Seneca Army Depot Activity to reduce their work force to 60 employees by October 1999, and by October 2000 there may be as few as 4 employees remaining at the depot (EPA, 1999).

Many of the depot's military personnel and their families lived in one of three on-post housing areas: Elliot Acres (124 units); Lake Housing (78 housing units and 5 community facilities); and North Depot (3 barracks for soldiers). Today, only a few units are occupied at Elliot Acres and Lake Housing, and the North Depot housing area is closed.

Based on redevelopment plans, the majority of the depot will be reused as a conservation and recreation area. The southeastern corner of the depot will be used for industrial development, a prison, and warehouses; the Coast Guard will retain a small portion of this area. An area for institutional use has been identified in the northern portion of Seneca Army Depot Activity. Housing areas will remain at Elliot Acres and Lake Housing. The airfield will be used for special events, institutional uses, and training (RKG Associates, Inc., 1996).

A total of 33,680 people live in Seneca County. The area of Seneca County surrounding the depot is sparsely populated with farmland and small towns. The small towns nearest to the depot, such as Varick, Ovid, Romulus, and Covert, each have a population of about 2,000 people (Woodward-Clyde, 1997). Approximately 680 housing units for about 2,300 people, including roughly 280 young children (aged 6 or younger) and 525 adults aged 65 and older, are located within one mile of the Seneca Army Depot Activity (ATSDR, 1998).

Quality Assurance and Quality Control

In preparing this public health assessment (PHA), ATSDR relied on environmental data and discussions with Seneca Army Depot Activity and local and state agency representatives. The majority of the environmental data presented in this PHA came from monitoring programs and detailed studies conducted by private contractors under contract with Seneca Army Depot Activity. The documents reviewed included the June 1994 solid waste management classification report; the December 1995 submittal of expanded site investigations (ESIs) at seven high-priority sites; and the RIs for individuals SWMUs, including the Ash Landfill, Open Burning Grounds, and the Abandoned and Active Deactivation Furnaces. The limitations of the data are identified in each of the associated reports.

Limited radiologic data were available from preliminary studies conducted at the depot. Additional information is needed before ATSDR can fully evaluate the potential public health

associated with radiologic contamination at the depot. Specific data needs are: (1) clearly defined background locations and measurements; (2) errors associated with the measured values; (3) and specific isotopic analysis to identify radium and uranium radionuclides. ATSDR has requested this information from the Army, along with additional boundary or off-site surface water samples; clarification of the methods used for soil and sediment radiological analysis; and a reevaluation of the soil and sediment samples. The Army is currently collecting this information through its RI for SEAD-12. Upon completion of the RI and receipt of the data, ATSDR will issue an addendum to this PHA.

EVALUATION OF POTENTIAL EXPOSURE PATHWAYS

Introduction

In this section, ATSDR evaluates potential pathways of exposure in more detail to determine whether contamination from Seneca Army Depot Activity poses public health hazards to people having access to, or living near, the site. Figure 3 describes the exposure evaluation process. As the figure indicates, ATSDR considers how people might come into contact with, or be exposed to, contaminated media. Specifically, ATSDR determines whether an exposure could occur through ingestion, dermal (skin) contact with contaminated media, or inhalation of vapors, and also considers the likely length (duration) and frequency of the exposure.

If exposure was or is possible, ATSDR then considers whether chemicals were or are present at levels that might be harmful to people. ATSDR does this by screening the concentrations of contaminants in an environmental medium against health-based comparison values. Comparison values are concentrations of chemicals that can reasonably and conservatively be regarded as harmless. The comparison values generally include ample safety factors to ensure protection of sensitive populations, such as children or the elderly. Because comparison values do not

represent thresholds of toxicity, exposure to contaminant concentrations above comparison values do not necessarily produce health effects. Data tables in this document list contaminants in each medium that are present in the environment at levels greater than, or equal to, the comparison values. If a chemical is found in the environment at the site at levels exceeding its corresponding comparison value, ATSDR examines potential exposure variables and the toxicology of the contaminant. ATSDR emphasizes that, regardless of the level of contamination, *a public health hazard exists only if people come in contact with, or are otherwise exposed to, the contaminated media.*

After an initial review of potential health hazards at the Seneca Army Depot Activity, ATSDR identified the groundwater, surface soil, surface water and sediment, and the food chain exposure pathways as requiring further evaluation. Following the strategy outlined previously ATSDR examined whether human exposure to harmful levels of contaminants via these pathways existed in the past, existed at the time the PHA was prepared (present), or could potentially exist in the future. ATSDR summarizes its evaluation of potential exposure pathways in Table 3 and describes it in more detail in the discussion that follows. To acquaint readers with terminology used in this report, a list of comparison values and a glossary are included in Appendices A and B, respectively.

Groundwater Exposure Pathway

After reviewing the available groundwater data, ATSDR has drawn the following conclusions:

- No past, current, or future public health hazards are associated with consuming chemically-contaminated water from groundwater-supplied drinking water wells.
- Most drinking water for the area comes from surface water sources and municipal water supply wells are located far from the site.

- A TCE plume has migrated beyond Seneca Army Depot Activity's western boundary, but has not affected downgradient private wells.

- ATSDR needs additional data to more fully evaluate potential future public health hazards from radiological contamination.

Discussion

Groundwater Use

Groundwater quality is considered to be minimally acceptable for potable use in many portions of Seneca County because of objectionable hardness caused by high levels of naturally occurring minerals (Engineering Science, Inc., 1994). For this reason, few people in Seneca County obtain their drinking water from groundwater sources. In fact, Seneca Army Depot Activity and most surrounding communities obtain drinking water from surface water sources.

Groundwater in the area around the depot flows in either an overburden (glacial till/weathered shale) aquifer, a shale bedrock aquifer, or a deep aquifer (limestone). Groundwater, when used for drinking water, is most likely drawn from the shale bedrock aquifer. Because Seneca Army Depot Activity is located on the western slope of a groundwater divide, groundwater flow from the site is generally westward and toward Seneca Lake, although the direction might vary locally depending on seasonal variation, pumping rates, or the quantity of infiltration of surface runoff.

A description of the few local groundwater-supplied drinking water sources on Seneca Army Depot Activity and in the surrounding communities follows:

- *On-Site Water Wells*: Roughly from the 1960s until 1993, four groundwater-supplied wells provided water for the Seneca Army Depot Activity. The wells are well #3, located along the western boundary, near the truck entrance, and wells # 4, #5, and #6, located near the Army Reserve Facilities at the former airfield (Seneca Army Depot Activity, 1998). It is uncertain, however, the extent to which these wells served as a source of drinking water for the depot (Seneca Army Depot Activity, 1999). Well # 3 serviced a

restroom and might have provided potable water, and wells # 4, # 5 and # 6 were used either for drinking water or for emergency use only. None of the wells has been used for any purposes since 1993.

- *Off-Site Public Drinking Water Wells*: No public water wells are located near the depot. The nearest public drinking water wells are located more than 5 miles away in the towns of Ovid and Interlaken. Ovid obtains its water from two shallow, gravel-packed wells, and Interlaken is served by a developed seepage spring (Engineering Science, Inc., 1994).

- *Off-Site Private Drinking Water Wells*: Although no recent, complete well survey exists, data collected through 1957 indicate that within a 4-mile radius of the site, 25 wells used water from the shale aquifer, and 6 wells used water from the deep limestone aquifer (Engineering Science, Inc., 1994). Without more detailed information, ATSDR cannot determine how long these wells were used or whether they supplied water used for drinking water. More recent documentation indicates that three wells located near the western boundary of the site still serve as drinking water sources for a nearby farm.

The Nature and Extent of Groundwater Contamination

Over the course of several RI and other environmental site investigations, the Army installed several hundred monitoring wells on and adjacent to the depot (Seneca Army Depot Activity, 1999). Many of these wells were been installed within and downgradient to source areas where contaminants were suspected to have entered the groundwater. The wells are also screened at different depths to provide information about the contaminant distribution in the different aquifers. The Army also sampled water from three private wells located along the western boundary of the site. The samples were analyzed for VOCs and metals, and a few samples were analyzed for radiological constituents.

Chemical Contamination

Of the chemical contaminants detected, VOCs pose the greatest threat to the underlying groundwater. Some of the highest VOC concentrations were measured in a two-acre area just northwest of the Ash Landfill (see Table 4). The landfill was used from 1974 until 1979 by the

Army for disposal of ash generated from the incineration of solid waste (trash) produced at the depot. VOCs, primarily TCE (up to 51,000 parts per billion [ppb]), 1,2-DCE (up to 130,000 ppb), and vinyl chloride (up to 23,000 ppb), were detected in groundwater in this area at concentrations above ATSDR comparison values, New York state drinking water quality standards, and EPA maximum contaminant levels (MCLs) (Parsons Engineering Science, Inc., 1993). Metals, including aluminum, cadmium, chromium, lead, and nickel, were also present at concentrations above ATSDR comparison values.

This VOC plume extends westward from the landfill to about 250 feet beyond the depot boundary and about 1,000 feet upgradient from the three farmhouse wells (see Figure 4). The leading edge of this plume is located immediately upgradient of monitoring well MW-56 and contains total VOCs, which include TCE, 1,2-DCE, and vinyl chloride, at a concentration of about 10 ppb. The plume is believed to be restricted to the till/weathered overburden aquifer where one of the farmhouse wells draws water; contamination has not entered the deeper bedrock or limestone aquifers where the other two farmhouse wells draw water (Parson Engineering Science, Inc., 1996a). Routine quarterly monitoring conducted to date indicates that the VOC plume has not affected the downgradient private wells, including the one farmhouse well, or any other off-site area.

The on-site supply wells are also unlikely to have been affected in the past by the VOC contamination because the wells are situated more than 7,000 feet cross-gradient to the plume and its source. In addition, on-site wells are unlikely to have been affected by other nearby potential sources of contamination. Well # 3 is approximately 1,300 feet downgradient from the Acid Storage Area (SEAD-65), but to date, there has been no evidence of a release at the site nor of contamination entering well #3, and the site requires no further action under CERCLA. Wells # 4, # 5, and # 6 are located near the airfield where fuels have been used. Sampling conducted by the Army shows that the groundwater beneath the airfield and well water have not been contaminated by chemicals used in this area (Seneca Army Depot Activity, 1999).

Between August 1994 and June 1995, the Army excavated contaminated soil suspected as the source of the VOC plume. The Army then successfully treated the excavated soil to achieve VOC clean-up criteria and then backfilled the clean soil into the original excavation areas. In the December 1996 feasibility study for the Ash Landfill, the Army proposed additional measures to control suspected sources and prevent movement of existing contamination from the landfill to off-site areas. The Army combined the Ash Landfill and several other SWMUs into the Ash Landfill OU to facilitate additional groundwater remediation activities (Parsons Engineering Science, Inc., 1996a).

Radiological Contamination

A preliminary historical sampling of groundwater in the beneath the Radioactive Waste Burial Sites (SEAD-12) and the Miscellaneous Components Burial Site (SEAD-63) found levels of radiological constituents at levels above MCLs. Location A of the Radioactive Waste Burial Sites reportedly stored radioactive wastes and nonradioactive laboratory wastes in five underground pits; no radioactive wastes were stored or disposed of at Location B. The Army excavated material from the pits in 1986 and confirmed, by follow-up surface level radiation readings, that all radioactive contamination had been removed. The Miscellaneous Components Burial Site was used during the 1950s and 1960s to store inert material (classified). Groundwater beneath either of these areas is not used as a drinking water source, nor is the aquifer connected to other aquifers used for drinking water (Parsons Engineering Science, Inc., 1995b).

The results of the preliminary sampling are presented in Table 5 and discussed as follows:

- *Radioactive Waste Burial Sites (SEAD-12)*: Gross alpha and gross beta radiation levels exceeded the MCL in five of six sampled monitoring wells. Gamma spectroscopy identified radium 226 (97 picocuries per liter [pCi/L] to 167 pCi/L) above the MCL of 5 pCi/L in the wells at Location B. The possibility exists that the radium did not truly exceed the MCL because gamma spectroscopy is not a precise method for identifying

radium levels.[2] The other gamma spectroscopically identified radionuclides were below MCLs.

- *Miscellaneous Components Burial Site (SEAD-63)*: In July 1994, three on-site monitoring wells in SEAD-63 were sampled. Gross alpha and gross beta radiation were detected at levels above MCLs in two samples; one was collected from the eastern portion of the area and the other, about 500 feet away was collected, along the west side of the patrol road.

It should be noted that the preliminary groundwater investigation did not quantify background concentrations of radionuclides in groundwater. Without these data, ATSDR cannot clearly determine whether radionuclides are attributed to artificial sources or naturally occurring. The Army is currently collecting more radiological information through its RI at SEAD-12.

Evaluation of Potential Public Health Hazards

No past, current, or future public health hazards are or were associated with consuming drinking water drawn from groundwater sources, although additional data are needed to more fully assess potential exposures to radiological contamination under future land uses. The following data support ATSDR's conclusion.

- On-site water wells are away from known sources of chemical or radiologic groundwater contamination and, therefore, most likely have been unaffected by site-related contamination.

- No contaminants were found at levels above EPA's MCL in private wells downgradient from the VOC plume that extends from the Ash Landfill. The Army will continue to monitor this plume and remediate its source to ensure existing contamination does not reach downgradient private wells. These measures should prevent future exposure to contaminants in groundwater. If, however, contaminants are detected in off-site

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[2] The gamma spectroscopy method used to identify radium 226 does not specifically identify the radionuclide. Rather, the method relies on the detection of a specific energy gamma-ray emission. Uranium 235, however, also emits that same energy gamma ray and more frequently, effectively masking the emissions from radium 226. Without the proper quality control procedures, the radium 226 detected might have been related more to the uranium 235 concentrations than the radium 226 actually present. Analyses via alpha spectroscopy would more accurately determine both the radium 226 and uranium 235 levels.

downgradient private wells, the Army will provide bottled water to those homeowners (Seneca Army Depot Activity, 1999).

- No public water supply wells are located near Seneca Army Depot Activity. The nearest public drinking water supply wells are located more than 5 miles from the depot and, therefore, are not likely to be affected by site contamination.

- EPA will require restrictions on the use of groundwater beneath the depot until post-remediation monitoring confirms that the groundwater is safe to drink.

- Preliminary data show that a few groundwater samples collected at Seneca Army Depot Activity contain radiological constituents. Despite these finding, ATSDR believes that no exposure to radiological constituents had occurred in the past or was occurring at the time this PHA because no drinking water supply wells exist in or downgradient from areas with suspected radiological material. Additional data that will become available through the SEAD-12 RI will assist ATSDR's evaluation of potential exposure under *future* land uses.

Soil Exposure Pathway

After reviewing available soil data, ATSDR concluded that:

- Exposure to chemically-contaminated soil at Seneca Army Depot Activity poses no past, current, or future public health hazard because exposure by depot workers was expected to be infrequent and of short duration, only low levels of contaminants are present at most sites, or the areas of contamination are generally inaccessible. In addition, the Army will remediate areas of contamination to prevent potential adverse health effects based on future reuse plans.

- ATSDR needs additional data to more fully evaluate potential future public health hazards from radiological contamination.

Discussion

Depot Use

Only a few people are likely to have had access to the depot on a regular basis because security measures (i.e., guarded entrances and perimeter fences) prevent public entry. Individuals allowed on site include authorized personnel and seasonal, permitted hunters. It should be noted that hunters are escorted and required to remain in their designated hunting location, typically an extensively vegetated, low-priority (low environmental hazard) area, for the duration of their hunt. Therefore, they are not likely to roam freely on the property or into highly contaminated areas.

The Nature and Extent of Soil Contamination

Activities associated with past depot operations have released chemicals to on-site soil. Through the RI and other site investigations, the Army collected soil samples from many of the source areas or SWMUs where VOCs and metals are suspected to have been released to the soil. The samples were analyzed for VOCs, metals, polycyclic aromatic hydrocarbons (PAHs), explosive compounds, and pesticides. Selected samples were also analyzed for radiologic constituents. Soil sampling has detected elevated levels of contaminants in several areas of the depot. Following is a more detailed description of the soil sampling conducted at the site:

- Elevated levels of metals, PAHs, and pesticides were found in several areas of Seneca Army Depot Activity. Some of the highest levels were found in surface soil samples gathered from the Abandoned Powder Burning Pit (SEAD-24), Open Burning Grounds (SEAD-23), the Munitions Washout Area (SEAD-4), the Fire Training Area (SEAD-26), and the Ash Landfill (SEAD-6) (see Table 6). Metals, including arsenic (up to 56.8 parts per million [ppm]), barium (up to 34,400 ppm), chromium (up to 4,870 ppm), and manganese (up to 120,000 ppm) were found at levels above ATSDR's comparison values for soil, as was the PAH benzo(a)pyrene (up to 9 ppm), and the pesticides DDT (up to 2.8 ppm) and dieldrin (up to 0.5 ppm). Although monitoring frequently detected lead, no

comparison value currently exists for this metal. Explosive compounds were also found, but generally at levels below comparison values (Parson Engineering Science, Inc., 1996b, 1997a, 1997b, 1997c).

- Preliminary soil sampling data that are currently available to ATSDR indicate that the levels of radiological constituents in soil might exceed health guidance levels. Since the preliminary data are limited, the additional data that will become available through the SEAD 12 RI activities will assist ATSDR's assessment of the extent of radiologic contamination in soil at the depot.

Evaluation of Potential Public Health Hazards

No past, current, or future public health hazards are associated with contaminants in soil at Seneca Army Depot Activity, but ATSDR needs additional data to fully assess the future potential public health hazards caused by exposures to radiologic contamination in soil. ATSDR bases its conclusion on the following observations:

- The depot is enclosed by a fence and has a guarded gate to restrict unauthorized access. Many areas containing contaminated soils are, therefore, inaccessible to the public because they are secured and located away from residential areas. In areas where contamination exists, the Army will remediate the soil to meet clean-up standards for the proposed use of the area. This should protect on-site workers and the people who may use the site in the future.

- On-site workers or hunters could have come in contact with or incidentally ingested soil, but the likelihood that workers during their routine responsibilities or hunters during their escorted access contacted the most contaminated soil for an extended period is remote. If workers or hunters did contact contaminated soil, exposure most likely was brief and infrequent and not of health consequence. Moreover, these individuals most likely wore protective clothing, which would further reduce exposure and any associated health effects.

- At the time of this PHA, the Army was remediating/removing chemically-contaminated soil (to meet appropriate clean-up criteria) as a precautionary measure to prevent exposure to on-site workers and to prevent chemical contaminants from leaching into groundwater.

- Existing data are not sufficient to allow a thorough assessment of potential public health hazards, if any, from radiologic contamination in soil. Because security measures a the

depot might be eliminated eventually as the land is transferred and future land uses might involve activities that allow contact with soil, ATSDR has requested from the Army additional radiological analyses. The data will become available upon completion of the RI for SEAD-12.

Surface Water and Sediment Exposure Pathway

After reviewing available surface water and sediment data, ATSDR has drawn the following conclusions:

- No past, current, or future public health hazards are associated with chemical contaminants found in the surface water or sediment of wetland areas of the depot or in creeks that travel through the property because either no or only low levels of site-related contaminants are present or the areas of contamination are inaccessible to the general public.
- ATSDR needs additional data to more fully assess the potential public health hazards associated with exposure to radiological contamination in surface water.

Discussion

Surface Water Use

Seneca Army Depot Activity is located on an upland area that forms the divide between two Finger Lakes, Cayuga Lake to its east and Seneca Lake to its west. The Seneca Army Depot Activity and surrounding communities, including the villages of Ovid, Waterloo, Watkins Glen, the city of Geneva, and the towns of Varick and Ramulus, use the lakes as a primary source of drinking water. In the past, surface water was drawn in from the lakes, tested, chlorinated (and fluoridated) at pump station 2411 at the depot before it was delivered to the users. Currently water is purchased from the Village of Waterloo, which uses Seneca Lake as their water supply. Waterloo furnishes water to the village, and several townships as well as Seneca Army Depot

Activity. Surface water from Cayuga Lake supplies drinking water for Seneca Falls, one of the largest communities in Seneca County. It should be noted that community water suppliers in New York State are required by law to monitor their water supply for a variety of chemical constituents. They are also required to monitor for radium-226, radium-228, and gross alpha particle activity at least every four years (NYSDOH, 1999a).

Eight creeks drain surface water from the depot into either of the two lakes. Principle creeks include: Kendaia Creek, which flows into Seneca Lake near the Lake Housing Area; Reeder Creek, a perennial creek generally less than 1 foot in depth, which flows into Seneca Lake from the north-central portions of the depot; and Kendig Creek, which drains the northeastern portion of the depot, including the Duck Ponds, into Cayuga Lake (Woodward-Clyde, 1997; Parsons Engineering Science, Inc., 1997c).The portions of the creeks located on the depot are not used in any way for recreational activity, but their off-site reaches might have been used for fishing.

The Nature and Extent of Surface Water and Sediment Contamination

The Army collected limited surface water and sediment samples in on-site reaches of Kendaia Creek and off-site reaches of Reeder Creek to determine whether contamination from any of the major source areas was entering surface water bodies. Reeder Creek flows through the Open Burning Grounds and Kendaia Creek flows about 4,500 feet north of the Ash Landfill area, before eventually discharging into Seneca Lake, about 1 to 2 miles downstream of the fence line of the depot property. It is suspected that contaminants enter these creeks when they pass through or near these waste areas. Kendaia Creek is of particular concern because it flows directly over bedrock, where surface water could intermingle with contaminated groundwater from the landfill. Samples were analyzed for VOCs, PAHs, metals, and pesticides. The results are presented in Tables 7 and 8.

The Army also collected a limited number of samples (four) to determine whether radiologic constituents had entered surface water. Samples were collected from the Miscellaneous Components Burial Site (SEAD-63), specifically from the boundary of the area, locations adjacent to the patrol road, and locations north of the service road, and analyzed for gross alpha and gross beta radiation.

A discussion of the results of surface water and sediment sampling follows:

- Monitoring revealed little or no chemical contamination above EPA MCLs in surface water. TCE, arsenic, and beryllium levels in both Kendaia Creek and Reeder Creek exceeded ATSDR comparison values, but were below EPA MCLs for drinking water. Manganese levels in Kendaia Creek greatly exceeded the ATSDR comparison value; much lower concentrations were found in Reeder Creek.

- Elevated levels of metals and PAHs were detected in the sediment of Kendaia Creek and off-site reaches of Reeder Creek. Also, copper and lead levels were above NYSDEC guidelines (no ATSDR sediment or soil guidelines for copper or lead currently exist) in both creeks, though substantially higher levels were recorded for Reeder Creek. Contaminants in Reeder Creek are likely related to former activities at the Open Burning Grounds. As part of remedial activities at the Open Burning Grounds, the Army will remove the contaminated sediment in Reeder Creek with concentrations of copper and lead above the NYSDEC criteria of 31 ppm and 16 ppm, respectively. (The NYSDEC guidelines were established as maximum values that would be protective of aquatic species.) In addition, the Army will develop vegetative stabilization of the soil at the Open Burning Grounds to minimize erosion and possible recontamination of Reeder Creek in the future (Parsons Engineering Science, Inc., 1997c).

- At most sampling locations, the radiological parameters were less than the enforceable MCL used for drinking water sources.[3] At one location, however, the gross alpha and gross beta concentrations were 107 pCi/L and 180 pCi/L, respectively. Additional data are needed to more fully characterize the nature and extent of radiological contamination in the surface waters and whether it poses a public health hazard.

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[3] Although the surface waters located on site at Seneca Army Depot Activity are not used as a source of drinking water, ATSDR used EPA's MCL for radioactive materials as a comparison value only and not as an indication that adverse health effects would occur if that MCL is exceeded even if people were drinking the water.

Evaluation of Potential Public Health Hazards

Based on available data, no past, current, or future public health hazards are associated with contaminants in surface water or sediment at Seneca Army Depot Activity. ATSDR needs additional surface water and sediment data to fully assess the potential future public health hazards caused by exposures to radiologic contamination in these media. ATSDR based its conclusion on the following:

- There is no indication that the creeks on the depot are widely used; therefore, it is unlikely that direct exposures to contaminated surface water or sediment had occurred in the past, or was occurring at the time of this PHA. Furthermore, the most contaminated sediments are generally inaccessible because they either are underwater or are away from areas where people (i.e., workers) are likely to frequent.

- No elevated levels of surface water chemical contaminants have been found in off-site reaches of Reeder Creek, so it is probably not likely that harmful levels of chemical contaminants have entered or are entering Seneca Lake. It should be noted that public drinking water that originates from the lakes is treated and has meet safe drinking water requirements before it is used, even for radiological constituents.

- Future land use will involve human activities that could allow for use of the creeks. As previously mentioned, the Army has cleaned or is cleaning contaminated source areas, has removed/removing contaminated sediment, and is taking measures to prevent erosion. These actions should ensure that future users of the site will not come into contact with potentially harmful compounds in surface water or sediment.

- ATSDR has requested that the Army clarify the sediment analytical methods and perform a reevaluation of the samples.

- Radiological constituents were detected in a few surface water samples collected as part a preliminary investigation. These data are not sufficient, however, to allow ATSDR to draw conclusions about potential health hazards associated with radiological parameters in surface water. ATSDR needs and has requested additional data from the Army.

Food Chain Exposure Pathway

After review of the food chain pathway, ATSDR drew the following conclusion:

- Consumption of venison poses no apparent public health hazard. Although contaminants have been detected in on-site soil where deer might graze, bioaccumulation studies demonstrate that deer are unlikely to accumulate harmful levels of contaminants.
- A fish survey at an on-site creek identified the minnow as the predominant fish species in an on-site creek. Minnows are unlikely to be fished for consumption or contribute to the diet of larger sport fish consumed by people.

Discussion

Recreational deer hunting is permitted only in designated areas of the depot during the fall season. The depot supports a herd of more than 500 white-tailed deer that graze throughout the property. About half of the site's deer population has a distinctive white coat caused by a rare genetic trait.

Indirect exposure to contaminants could result in persons consuming deer that accumulated site-related contaminants. ATSDR does not know whether deer at Seneca Army Depot Activity have accumulated site-related contaminants, however. To date, no study has been conducted to monitor accumulation of contaminants, if any, by the depot's grazing deer population. In the absence of site-specific data, ATSDR reviewed the findings of studies that investigated whether deer grazing at other Army sites had accumulated chemical contaminants similar to those found at Seneca Army Depot Activity. The results of those studies indicated that little, if any, uptake of chemicals occurred in grazing deer (USACHPPM, 1994; USAEHA, 1994).

Assuming similar conditions exist at Seneca Army Depot Activity, harmful levels of site-related contaminants are not likely to accumulate in grazing deer. Therefore, ATSDR feels that people

who eat a moderate amount of venison from deer from the depot are not likely to experience any harmful health effects

Fishing occurs in off-site reaches of creeks that travel through the depot. No data are available to indicate whether recreational sport fish in these creeks have accumulated contaminants. The Army surveyed fish in Kendaia Creek, but the predominant fish species, the minnow, is not considered a sport fish. While these fish might only occasionally migrate to off-site reaches, it is unlikely that they are fished or even contribute to the diet of the larger sport fish. These findings suggest that fish in off-site reaches might not accumulate site-related contaminants, but supporting data are needed to allow a full evaluation.

COMMUNITY HEALTH CONCERNS

During the public health assessment process, ATSDR talked with community members and local officials. Through these discussions, community representatives expressed the following concerns about environmental conditions and potential health hazards at the Seneca Army Depot Activity.

- *Concern that breast cancer rates seem higher than normal in areas near the Seneca Army Depot Activity.*

ATSDR reviewed cancer incidence and mortality rates in Seneca County, New York, reported in the *Cancer Incidence and Mortality by County, 1976-1995, Cancer Incidence and Mortality by County, 1992-1996, and the Seneca County Department of Health's Community Health Assessment* (NYSDOH, 1998; 1999b; Seneca County Health Department, 1998). Data indicates that breast cancer incidence in Seneca County increased over the period from 1976 through 1990. Similarly, an increase in breast cancer incidence was observed for the state of New York (excluding New York City). Most recently (from 1992 through 1996), the breast cancer rate in

Seneca County (94.5 per 100,000 women) has exhibited a downward trend, which is now below both national and Upstate New York (105.6 per 100,000 women).

A number of reasons may account for the variation in rates:

- Seneca County has a relatively small population. The breast cancer rates per 100,000 are estimates based on the numbers of actual breast cancers diagnosed in Seneca County. When we estimate the rate, small difference year to year in the number of cases diagnosed in Seneca County may appear as a much larger differences in a population 100,000.

- Higher rates can occur by chance. Over a short period of time or over a small geographic area, cases of cancer might cluster together by chance. If we extend the time or consider a larger area, more meaningful patterns of cancer incidence are likely to emerge.

- Increased Breast Cancer Screening. Better and more available screening for cancer leads to earlier detections of breast cancer than in the past, causing a short-term rise in breast cancer incidence.

The documents available for review by ATSDR did not allow an analysis of whether activities at the Seneca Army Depot Activity could be associated with, or might contribute to, breast cancer incidence in Seneca County. When assessing the threats to the public's health, however, ATSDR examines the potential exposure pathways related to a site. In the event ATSDR finds a *completed exposure pathway* posing a public health threat, ATSDR reviews health outcome data (e.g., cancer rates) *in combination* with environmental and exposure data to see whether an association exists. As stated, ATSDR did not find a completed exposure pathway posing a public health hazard. Therefore, based on the data available for review, ATSDR does not believe that contaminants from the Seneca Army Depot Activity are responsible for health problems such as breast cancer.

The New York State Department of Health (NYSDOH) monitors cancer incidence in New York. Community members with questions about cancer rates in the area surrounding the Seneca Army Depot Activity site can call the NYSDOH's Cancer Surveillance Program in the Bureau of Chronic Disease Epidemiology and Surveillance at (518) 474-2354.

- *Concern about radioactive material entering surface water used for water supplies.*

Seneca Army Depot Activity has used and stored radioactive materials on site, and radiological wastes were also stored at the depot in the 1940s. Because of insufficient existing data (as outlined in the *Evaluation of Potential Exposure Pathways* section), ATSDR was unable to fully assess potential health hazards, if any, associated with radioactive materials in environmental media at Seneca Army Depot Activity. The Army is completing an RI report that characterizes the extent of radiological contamination associated with SEAD-12. ATSDR has requested this report and other additional data to further assess the extent of radiologic contamination in soil at the depot. Upon review of that information, ATSDR will issue an addendum to this public health assessment.

- *Concern about exposure to radon in on-site buildings.*

In the 1940s, the Army used 11 igloos in the ammunition area for storage of pitch blended ore. Eventually the ore was removed, and the igloos were used to store conventional weapons. As a consequence of storage, however, radon-22 permeated the air of the warehouse buildings. a 1977 U.S. Army Environmental Hygiene Agency survey indicated that buildings contained radon-22 concentrations ranging from 0.92 to 3.12 pCi/L, while just outside the buildings a much lower concentration (0.23 PCi/L) was measured. All measured concentrations are safely below the maximum permissible concentration of radon in an unrestricted area (4.0 pCi/L) (Woodward-Clyde, 1997). Using available toxicologic information, ATSDR found no clear evidence that long-term exposure to radon at levels found at the depot is likely to result in harmful health

effects. Most of the general population would not have been exposed because access to the site is restricted. Therefore, ATSDR concludes that the levels of radon gas detected in and around storage buildings are below levels associated with public health hazards.

- *Concern about safety hazards associated with unexploded ordnance (UXO) that may remain on site after the land is transferred.*

UXO exists in several areas of the Seneca Army Depot Activity. Because future land use will involve activities that might allow contact with UXO, the Army will clear areas, such as the Open Burning Grounds, to ensure that future users of the site will not contact potentially harmful ordnance or associated compounds. The Army will conduct an initial magnetic sweep, flag suspect areas, and then remove the UXOs. As an added measure, the Army will excavate surrounding soil and, if necessary, sift it to remove UXO and metal debris before disposing of the soil (Parsons Engineering Science, Inc., 1997c).

ATSDR CHILD HEALTH INITIATIVE

ATSDR recognizes that infants and children might be more sensitive than adults to environmental exposures in communities faced with contaminated water, soil, air, or food because (1) children are more likely to be exposed to certain media, like soil, when they play outdoors; (2) children are shorter and, therefore, might be more likely to breathe dust, soil, and vapors close to the ground; and (3) children are smaller than adults and, therefore, might receive a higher dose of toxic exposure relative to their body weight. Children also can sustain permanent damage if exposed to toxic substances during critical growth stages. ATSDR is committed to evaluating children's special interests at sites such as the Seneca Army Depot Activity as part of its Child Health Initiative.

ATSDR evaluated the likelihood that children living near the Seneca Army Depot Activity might have been or might be exposed to contaminants at levels of health concern. **ATSDR identified no situations in which children are likely to be or to have been exposed to harmful levels of chemical contaminants originating from Seneca Army Depot Activity**. ATSDR based its conclusion on the following factors:

- *Children have not been nor should they in the future be exposed to harmful contaminants when drinking water.* Area public water supplies have not been affected by contamination originating from Seneca Army Depot Activity. Seneca Army Depot Activity and the majority of the surrounding communities obtain drinking water from surface water sources. The area water suppliers regularly test their water supplies to ensure that public water is safe to drink. In addition, the Army will continue to test groundwater and treat contaminated areas to best protect the underlying aquifers and prevent contamination from reaching off-site water supplies in the future.

- *Children have not been exposed to harmful levels of contaminants in soil, surface water, or sediment.* The site has a secured entrance, preventing unsupervised children from wandering on site. Therefore, children likely have not been on the Seneca Army Depot Activity and come in contact with contaminated on-site soil, surface water, or sediment, Moreover, harmful levels of contaminants have not migrated off site beyond site boundaries to where children might play.

- *Children who may have eaten game or fish caught from on or near the site probably have not been exposed to harmful levels of contaminants.* Supporting fish data are needed to enable a full evaluation, however.

- Based on a review of the available data, ATSDR believes that children have not been exposed to harmful levels of radiological constituents. Additional data that will become available through the SEAD-12 RI will assist ATSDR's evaluation of potential exposure under future land uses.

CONCLUSIONS

ATSDR concludes that *no apparent public health hazards* are associated with the Seneca Army Depot Activity, but additional data are needed to more fully assess potential public health

hazards, if any, associated with radiological contamination at the site. ATSDR based it conclusions on the following factors:

- No apparent public health hazards are associated with groundwater contaminated with site-related chemicals. Although elevated levels of VOCs and metals have been measured in on-site groundwater, no drinking water sources are located near the area of contamination. In fact, most water supplies draw from surface water sources unaffected by the on-site groundwater contamination. At the time of this PHA, the Seneca Army Depot Activity was continuing to monitor the VOC plume extending from the Ash Landfill and test downgradient private well water to ensure that the water remains safe to drink.

- No apparent public health hazards are associated with on-site soil, sediment, and surface contaminated with site-related chemicals. The general public probably had minimal contact, if any, with contaminated on-site media because a security fence limits public access to the site and the contaminants do not appear to have migrated off site. Hunters at the site most likely have not contacted contaminated soil with great frequency or for any significant time. Some contaminated areas have been remediated, while other areas await cleanup.

- Consumption of venison poses no apparent health hazard. Although contamination was detected in soil in areas where deer graze, studies demonstrate that chemicals similar to those detected at the Seneca Army Depot Activity are not readily accumulated by grazing animals.

- Radiological constituents have been detected in a few groundwater and surface waters samples taken at the depot property. Without additional data, however, ATSDR cannot adequately assess the potential public health hazards, if any, associated with radiological contamination at the site.

- Data indicates that breast cancer incidence in Seneca County increased over the period from 1976 through 1990. Similarly, an increase in breast cancer incidence was observed for the state of New York (excluding New York City). Most recently (from 1992 through 1996), the breast cancer rate in Seneca County (94.5 per 100,000 women) has exhibited a downward trend, which is now below both national and Upstate New York (105.6 per 100,000 women).

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for Seneca Army Depot Activity contains a description of actions taken by ATSDR, the Army, EPA, and state and local health departments at and in the vicinity of the site. The purpose of the PHAP is to ensure that this public health assessment not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposures to hazardous substances in the environment. The public health actions that are completed, being implemented, or planned are as follows:

Completed Actions

1. The Army identified 72 SWMUs in accordance with the criteria outlined in by USACE, EPA, and NYSDEC. To date, 25 sites require no further action.

2. Seneca Army Depot Activity has completed four RIs and identified 13 OUs for the site. At the time of this PHA, additional RIs were under review and several more were in progress.

3. Seneca Army Depot Activity treated the contaminated soil in the Ash Landfill via low-temperature thermal absorption. The soil is a suspected source of the VOC plume emanating from the landfill. The Army has proposed additional measures to treat contaminated groundwater.

4. The Army surveyed for radon and lead in on-site buildings and identified buildings and areas where UXOs were stored.

5. The Army conducted a decommission survey in 1992 and 1993 at 64 Special Weapons Area Ammunition Igloos, confirming that these igloos have no residual radiation contamination.

6. ATSDR conducted a preliminary review of breast cancer incidence and mortality in Seneca County.

Ongoing or Planned Actions

7. The Seneca Army Depot Activity, EPA, and NYSDEC will work together to ensure that potential public health hazards at the site are thoroughly investigated and appropriate remedial actions are taken to protect the health and well-being of the public.

8. Seneca Army Depot Activity continues to regularly monitor groundwater in the VOC plume near the Ash Landfill to ensure compliance with EPA and New York guidelines.

9. Seneca Army Depot Activity has proposed soil and sediment remediation for on-site areas such as the Open Burning Ground where contamination has been detected.

10. Seneca Army Depot Activity will conduct slope stabilization near Reeder Creek as necessary to prevent surface water runoff from migrating to the creek.

11. Seneca Army Depot Activity will continue to provide information to the surrounding community and interested parties about results of environmental investigations and remediation status for the site.

12. Seneca Army Depot Activity will continue monitoring of the private farmhouse wells that are located downgradient from the plume near the Ash Landfill. The depot will offer alternative water supplies to the owners of the off-site private farmhouse wells if contamination should reach the wells.

13. The Army continues toward completion of the RI for SEAD 12 and will provide the report to ATSDR when it is completed Upon receipt of requested radiological data, ATSDR will assess potential public health hazards and issue an addendum to this report.

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TABLES

Table 1. Geographic Areas of Seneca Army Depot Activity

Geographic Area	Use History	Acreage	Status
Main Depot Area	The area was used primarily for storage of munitions and general supplies, industrial and administrative activities, and military training.	6,691 acres	Active.
North Depot and Special Weapons Area	North Depot: This portion of the depot provided troop housing, troop support, and community services. Special Weapons Area: From 1956 through 1963, this area was used for storing "special weapons." Many of the details regarding the special weapons mission at the depot remain classified.	180 acres 700 acres	Inactive (but housing may be reused in the future).
South Depot Area	This area is the major administrative and support area for Seneca Army Depot Activity. It also contains medical-related facilities and family housing.	200 acres	The area is still used for its administrative and support activities.
Airfield Area	This area consisted of an airfield, buildings, and a training range.	520 acres (consisting of a 65-acre training range and a 460-acre airfield)	The airfield is inactive, but the Army may transfer the property to the Seneca County Industry Agency in the future.
Lake Housing Area	The Lake Housing Area consists of family housing, community facilities, and outdoor recreation areas.	200 acres	Today, only six families live in the housing complex.
Coast Guard Area	The U.S. Coast Guard maintains an installation consisting of a single building, an underground storage tank, and a transmitter antenna tower.	292 acres	Active.

Source: Engineering Science, Inc., 1994; Seneca Army Depot Activity, 1999.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-3 Incinerator Cooling Water Pond	From 1974 to 1979, the pond was used to hold cooling water and fly ash generated from the scrubber of the solid waste incinerator. The ash was removed every 18 months and disposed at the Ash Landfill.	*Groundwater*: Sulfates and possibly metals were detected (levels are unknown).	The area is being investigated under the remedial investigation and feasibility study (RI/FS) with SEADs 6, 8, 14, and 15.	No public health hazard is likely to exist because the groundwater beneath the site is not used for drinking water.
SEAD-4 Munitions Washout Facility	From 1948 to 1963, operations at this facility included dismantling and removing explosives from munitions by steam cleaning; this operation produced explosive solids and wastewater. Today, this site is inactive. On-site workers may visit the area for security reasons only. Deer hunting is, however, conducted in this area during the fall.	*Groundwater*: Metals, semivolatile organic compounds (SVOCs), and nitrate were detected (levels are unknown). *Surface and Subsurface Soil*: Metals and/or SVOCs were detected at levels above ATSDR's comparison values (CVs). No explosive compounds were detected.	The area is being investigated under an RI/FS.	The site is presently accessed occasionally by workers. The groundwater is not used for drinking water, so public exposure is limited and not likely to pose a public health hazard.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-6 Abandoned Ash Landfill	The approximately 4-acre landfill received ash from the refuse burning pits from 1941 until the late 1950s or early 1960s. Later, after the incinerator was built, ash was again disposed in the landfill. The refuse was dumped in piles and occasionally spread and compacted, but never covered. Currently, the area is covered with vegetation.	*Groundwater*: Volatile organic compounds (VOCs), primarily trichloroethylene (TCE), 1,2-dichloroethylene, and vinyl chloride were detected at levels above CVs. These compounds are more likely related to the refuse burning pits or areas near the landfill rather than to the Ash Landfill contents. *Surface and Subsurface Soil*: Metals and/or SVOCs were detected at levels above CVs. No explosive compounds were detected.	The area is being investigated under the RI/FS with SEADs 3, 8, 14, and 15.	To date, no public health hazards exist from direct contact/use of contaminated groundwater beneath the site. The site is presently accessed only by on-site workers, so direct contact with soil is limited and not likely to pose a public health hazard. The groundwater flows west to southwest across the landfill and toward three farmhouse wells (less than 1/4 mile downgradient from the edge of the VOC plume). Samples collected from the farmhouse wells, however, have met safe drinking water standards. Seneca Army Depot Activity will continue to monitor groundwater in the area of the private wells.
SEAD-8 Non-Combustible Fill Area	Covering 3 acres, the fill area was used from 1974 to 1979 for burial of bulky items that could not be burned or incinerated. Currently, the area is closed and covered with vegetation.	*Groundwater*: Explosive compounds and metals were detected; some explosive levels exceeded CVs.	The area is being investigated under the RI/FS with SEADs 3, 6, 14, and 15.	No public health hazard exists because the groundwater beneath the site is not used for drinking water.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-14 Refuse Burning Pits	From 1941 to 1974, two 40 by 80 foot refuse pits were used to burn the depot's rubbish. The resulting ash was pushed into the adjacent landfill.	*Groundwater*: Solvents and metals were detected (levels unknown).	The area is being investigated under the RI/FS with SEADs 3, 6, 8, and 15.	No public health hazard exists because the groundwater beneath the site is not used for drinking water.
SEAD-15 Abandoned Solid Waste Incinerator (Building 2207)	The incinerator operated from 1974 to 1979 to burn the depot's domestic waste. Small munitions and asbestos were occasionally burned. The incinerator was destroyed by fire in 1979.	*Air*: The furnace operated without air pollution device, and therefore pollutants may have escaped during incineration. Propellents were probably completely destroyed in the furnace, but metals (e.g., lead and barium) probably exited in fly ash or dust.	The area is being investigated under the RI/FS with SEADs 3, 6, 8, and 14.	Without past air monitoring data, ATSDR cannot determined whether harmful levels of contaminants left the site. Since the incinerator is abandoned, no current or future public health hazard exists.
SEAD-16 Abandoned Deactivation Furnace (Building S-311)	The furnace was used for incinerating obsolete small-arms munition. The furnace contained no pollution or dust control devices. Air emissions from the furnace combined with wind dispersion may have caused deposition of particulates containing explosive compounds and/or metals to the soil.	*Surface Soil*: SVOCs were infrequently detected at levels above CVs.	The area is being investigated under an RI/FS.	No public health hazard exists because direct contact with contaminants in surface soil is limited.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-17 Existing Deactivation Furnace (Building 367)	Since 1962, the furnace has been used to safely detonate ammunition. The residue from the furnace is transferred by a conveyor to an approved hazardous water container, cooled, and then transferred to the Defense Reutilization and Market Office.	*Groundwater*: Metals and/or explosives were detected; concentrations of some compounds exceeded CVs. *Surface and Subsurface Soil*: Metals, SVOCs, polychlorinated biphenyls (PCBs), pesticides, and nitrate were detected. Some metal levels exceeded CVs.	The area is being investigated under an RI/FS.	The site is presently accessed occasionally by workers. The groundwater is not used for drinking water and therefore unlikely to pose a public health hazard.
SEAD-23 Open Burning Ground	From the late 1950s to 1986 or 1987, the open burning ground was used for burning munitions waste. The area consists of nine burning pads covering approximately 30 acres. The pads are constructed of broken shale.	*Groundwater*: Metals, nitrate, and/or explosives were detected; concentrations of some compounds exceeded CVs.	The public comment period on the proposed remedial action plan extended from December 1, 1997, through January 10, 1998. The record of decision was finalized in June 1999. Soil with greater than 500 ppm of lead will be excavated and disposed of off site. Soil with less than 500 ppm of lead with be covered and vegetated.	No public health hazard exists because the groundwater beneath the site is not used for drinking water.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-24 Abandoned Powder Burning Pit	During the 1940s and 1950s, the burning pit was active, though the operating practices are unknown. The primary source of contaminants considered for this site, however, are black powder, M10 and M16 solid propellants, and probably explosive-containing sawdust.	*Groundwater*: No VOCS were detected. Iron and manganese were found, but they were attributed to high turbidities in the samples. *Surface and Subsurface Soil*: VOCs, SVOCs, and metals were detected, but generally at levels below CVs. Explosive compounds (2,4-dinitrotoluene) exceeded CVs.	This area was investigated under the ESI at the high priority AOCs.	The site is presently accessed occasionally by workers. The groundwater is not used for drinking water, so public exposure is remote and not likely to pose a public health hazard.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-25 Fire Training and Demonstration Pad	Starting in the 1960s, this area was used for fire control training. Currently the pad is not used.	*Groundwater*: VOCs and SVOCs were detected; some concentrations exceeded CVs. Iron, manganese, and sodium were detected but are not directly associated with site activities. Total petroleum hydrocarbons were also present (no CVs currently exist for this group of compounds). *Surface and Subsurface Soil:* VOC, primarily benzene, toluene, ethylbenzene, and xylenes, were present in the surface soil. High levels of lead were also found in samples containing high VOCs and SVOCs. Metals and pesticides were detected at levels above CVs.	The area is being investigated under an RI/FS.	The site is presently accessed occasionally by workers and the groundwater is not used for drinking water, so public exposure is remote and not likely to pose a public health hazard.

Table 2. Evaluation of Potential Public Health Hazards Associated with Operable Units at Seneca Army Depot Activity (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Current Status	Evaluation of Public Health Hazards
SEAD-26 Fire Testing Pit	Since 1977, the area has been used one or two times each year for fire fighting training exercises, which involve igniting and extinguishing fuels. The area around the pit was used to store burned vehicles and fuel drums.	*Groundwater:* No VOCs, pesticides, PCBs, or explosive compounds were detected in the groundwater samples. SVOCs were infrequently detected but at levels below CVs Metals (arsenic, beryllium, lead, and zinc) were detected but were possibly caused by high turbidity. *Surface and Subsurface Soil*: SVOCs were detected at levels exceeding CVs.	The area is being investigated under an RI/FS.	The site is presently accessed occasionally by workers. The groundwater is not used for drinking water, so public exposure is remote and not likely to pose a public health hazard.
SEAD 45 Open Detonation Grounds	Since 1941, the Army detonated munitions in the open detonation grounds.	*Groundwater*: Metals and pesticides were detected at levels above CVs. *Surface and Subsurface Soil*: Metals, SVOCs, and explosive compounds were detected; levels of some compounds exceeded CVs.	This area was investigated under the ESI at the high priority AOCs.	The site is presently accessed occasionally by workers. The groundwater is not used for drinking water, so public exposure is remote and not likely to pose a public health hazard.

Sources: Engineering Sciences, Inc., 1994; Woodward-Clyde, 1997; Parsons Engineering Science, Inc., 1995a; Absolom, 1999.

TABLE 3. Potential Exposure Pathways

Pathway Name	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Comment
Private off-site wells	TCE: Ash Landfill	Groundwater	Private residences	Ingestion, dermal contact, and inhalation	Private residents (estimated 8-20 individuals)	**Past and Current**: • No exposure has occurred, nor is exposure occurring. A VOC plume extends beyond the site's western boundary. No contamination has been detected in the three farmhouse wells just downgradient of the leading edge of the plume. **Future**: • Seneca Army Depot Activity will continue to monitor groundwater and private wells downgradient of the plume.
On-site water supply wells	Operations at Seneca Army Depot Activity	Groundwater	Seneca Army Depot Activity	Ingestion, dermal contact, and inhalation	Workers or future visitors to the site	**Past and Current**: • No exposure has occurred or is occurring. **Future:** • Upon receipt, ATSDR will evaluate radiological data to assess future hazards.

TABLE 3. Potential Exposure Pathways (continued)

Pathway Name	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Comment
On-site surface soil	Operations at Seneca Army Depot Activity	Soil	Areas of exposed soil	Dermal contact	Seneca Army Depot Activity workers and hunters	**Past, Current, and Future**: • Site-related contaminants exist in on-site soil. Workers in the contaminated areas should not experience health effects because they most likely wore and continue to wear protective clothing and/or have had only brief, infrequent contact with contaminated soil. Upon receipt of data, ATSDR will review radiological data to assess hazards under future land uses.
Surface water/sediment	Operations at Seneca Army Depot Activity	Surface water or sediment	Creeks and lakes	Dermal contact, possible ingestion	Various groups	**Past, Current, and Future**: • No public health hazards from chemical contamination exist. Upon receipt of data, ATSDR will assess radiological hazards under future uses.

TABLE 3. Potential Exposure Pathways (continued)

Pathway Name	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Comment
Biota	Operations at Seneca Army Depot Activity	Game and fish	On-site	Ingestion	Consumers of game and fish	**Past, Current, and Future:** • ATSDR determined that the game and fish are not likely to accumulate contaminants at levels associated with adverse health effects.

TABLE 4. Summary of Contaminant Concentrations in On-Site Groundwater (Ash Landfill)

Contaminant	Concentration (ppb)		Comparison Value (ppb)
	Maximum	Mean	
1,2-Dichloroethene (total)	130,000	2,656	5 NY DWQS 70 MCL(cis)
1,1,1-Trichlroethane	2,100	28	5 NY DWQS 200 MCL
Trichloroethylene	51,0000	1,431	5 NY DWQS 5 MCL
Vinyl chloride	23,0000	649	0.7 CREG 2 MCL
Aluminum	306,000	20,713	50 NY DWQS
Cadmium	65	3	10 MCL 5 NY DWQS
Chromium	418	31	5 MCL (VI) 10 NY DWQS (VI)
Lead	147	11	15 NY DWQS
Nickel	622	43	100 MCL 100 NY DWQS

Sources: Parsons Engineering Science, Inc., 1996a.

Key: CREG= ATSDR's cancer risk evaluation guide; MCL= EPA's maximum contaminant level; NY DWQS= New York state drinking water quality standard.

TABLE 5. Summary of Radiological Constituents in On-Site Groundwater

Radiological Constituent	Concentration (pCi/L) Range	Comparison Value (pCi/L)
Radiation Levels		
Gross alpha	4 - 130	15 MCL
Gross beta	7 - 130	50 MCL
Radionuclides[1]		
Radium-226 [2]	97 - 167.4	5 MCL
Lead-214	22.4 - 57.5	10,600 MCL[3]
Bismuth-214	58.9 - 96	13,500 MCL[3]
Uranium-235	44 - 68.8	no value
Hydrogen-3 (Tritium)	60 - 900	20,000 MCL

Sources: Parsons Engineering Science, Inc., 1995b, 1996c, and 1998a

[1] Expressed values are the average of multiple analyses of the radionuclide using different spectral lines from the gamma spectroscopy system.
[2] For radium, EPA's MCL is for radium-226 plus radium-228.
[3] EPA's MCLs for lead and bismuth were estimated using an ingestion rate of 2 liters of water per day for a year and the dose conversion factors from ICRP 68.

Key: MCL= EPA's maximum contaminant level; pCi/L=picocuries per liter.

TABLE 6. Contaminant Concentrations in On-Site Surface Soil[1]

Contaminant	Maximum Concentration (ppm)	Locations of Maximum Detection	Comparison Value (ppm)
Arsenic	56.8	Abandoned Powder Burning Pit (SEAD-24)	0.5 CREG 20 EMEG-child
Barium	34,400	Open Burning Grounds (SEAD-23)	4,000 RMEG
Cadmium	14.3	Deactivation Furnace (SEAD-17)	10 EMEG-child
Chromium	4,870	Munitions Washout Area (SEAD-4)	300 RMEG-child
Lead	58,700	Open Burning Grounds (SEAD-23)	no value
Manganese	120,000	Fire Training Pit (SEAD-26)	7,000 RMEG-child
PAHs (benzo(a)pyrene)	9	Ash Landfill (SEAD-)	0.1 CREG
DDE	0.83	Open Burning Grounds (SEAD-23)	2 CREG
DDT	2.8	Open Burning Grounds (SEAD-23)	2 CREG
Dieldrin	0.5	Open Burning Grounds (SEAD-23)	0.04 CREG 3 EMEG-child

Source: Engineering Science, Inc., 1994; Parsons Engineering Science, Inc., 1995a.

Key: CREG = ATSDR's cancer risk evaluation guide; RMEG =ATSDR's reference dose media evaluation guide; EMEG=ATSDR's environmental media evaluation guide.

[1] Based on environmental monitoring data collected for the highest priority areas.

TABLE 7. Summary of Contaminant Concentrations in On-Site Surface Water

Contaminant	Concentrations (ppb)		Comparison Value (ppb)
	Reeder Creek	Kendaia Creek	
	Maximum	Maximum	
Trichloroethylene	5.0	12	3 CREG 5 MCL
Arsenic	1.9	2.90	0.02 CREG 3 EMEG-child 50 MCL
Beryllium	1.4	1.2	0.008 CREG 50 RMEG-child 4 MCL
Manganese	236	16,700	50 RMEG

Sources: Parsons Engineering Science, Inc., 1996a, 1997c.

Key: CREG= ATSDR's cancer risk evaluation guide; RMEG=ATSDR's reference dose media evaluation guide; MCL= EPA's maximum contaminant level.

TABLE 8. Summary of Contaminant Concentrations in On-Site Sediment

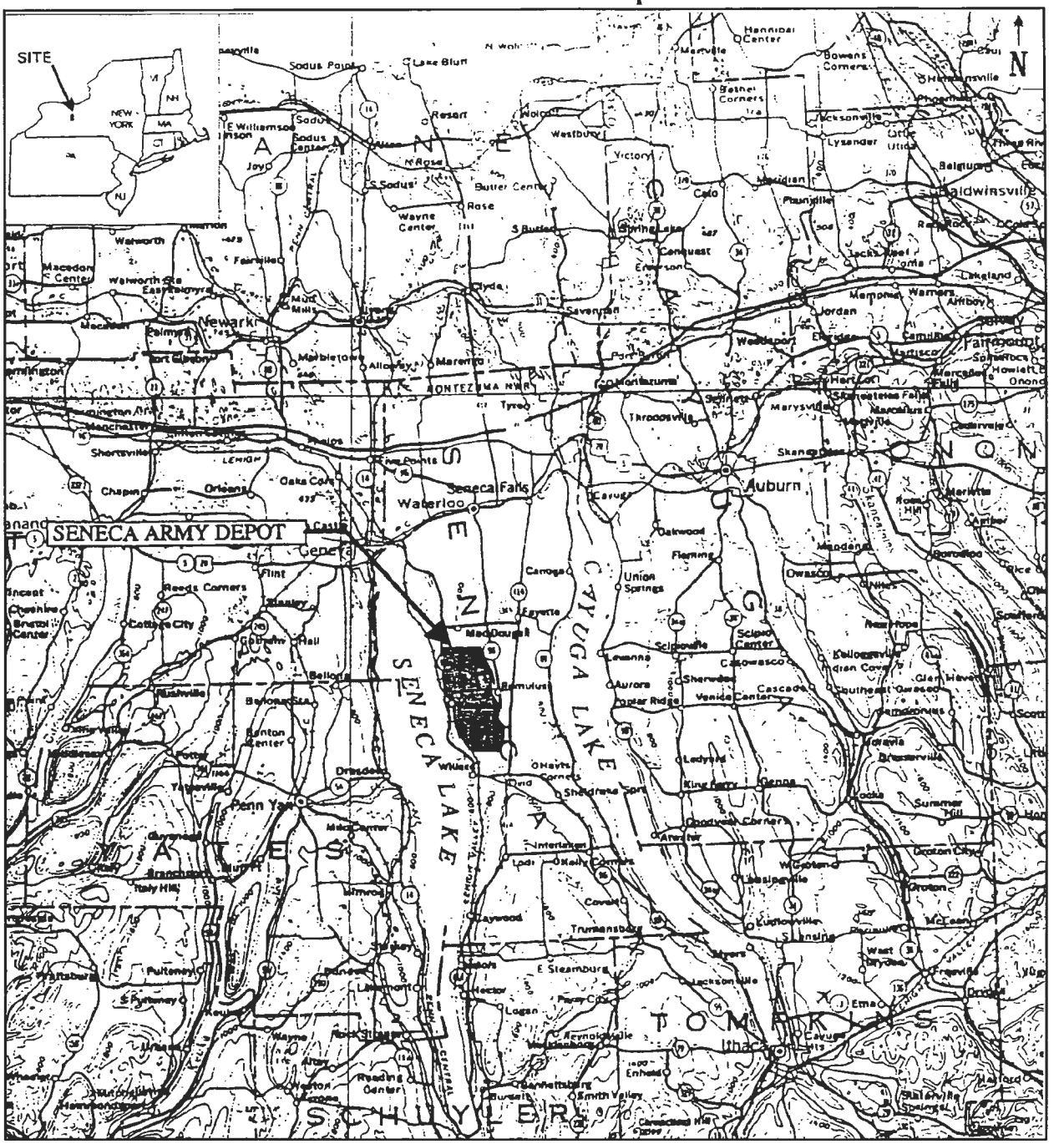
Contaminant	Concentrations (ppm)		Comparison Value (ppm)
	Reeder Creek	Kendaia Creek	
	Maximum	Maximum	
Benzo(a)pyrene	490	3,600	0.1 CREG
Arsenic	7.4	12	0.5 CREG 20 EMEG-child
Beryllium	0.7	1	0.2 CREG 300 RMEG-child
Copper	2,380	59	16 NYSDEC Sediment Guideline
Lead	332	219	31 NYSDEC Sediment Guideline

Sources: Parsons Engineering Science, Inc., 1994; 1997c.

Key: CREG = ATSDR's cancer risk evaluation guide; RMEG = ATSDR's reference dose media evaluation guide; NY DEC= New York Department of Environmental Conservation.

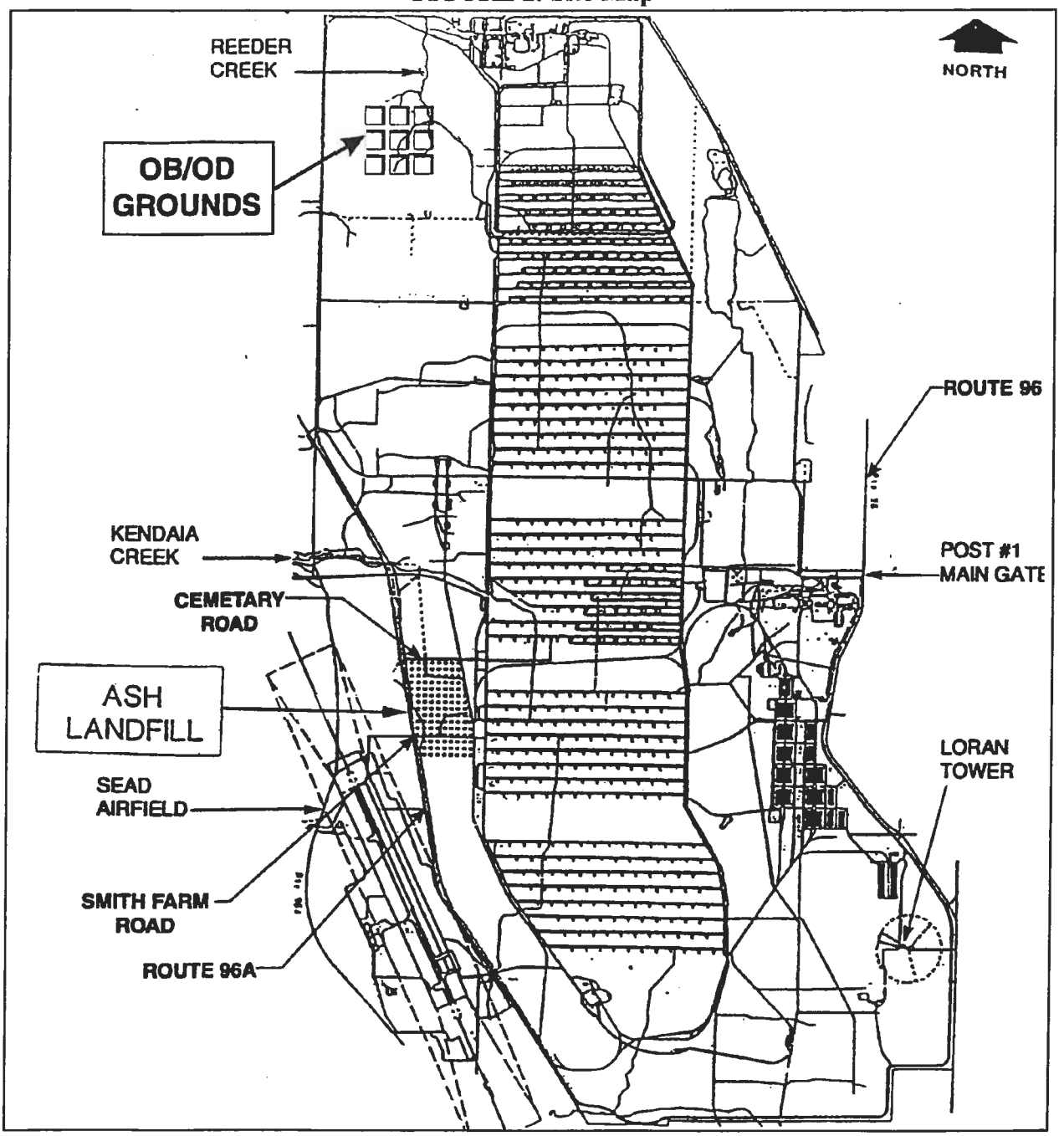
FIGURES

FIGURE 1. Area Map



Source: Parsons Engineering Science, Inc., 1997a.

FIGURE 2. Site Map



Source: Parsons Engineering Science, 1997c.

FIGURE 3. ATSDR's Exposure Evaluation Process

REMEMBER: For a public health threat to exist, the following three conditions must all be met:

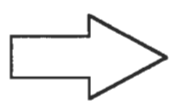
- People must come into contact with areas that have potential contamination
- Contaminants must exist in the environment
- The amount of contamination must be sufficient to affect people's health

Are People Exposed To Areas With Potentially Contaminated Media?

For exposure to occur, contaminants must be in locations where people can contact them.

People may contact contaminants by any of the following three exposure routes:

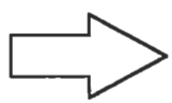
Inhalation
Ingestion
Dermal absorption



Are the Environmental Media Contaminated?

ATSDR considers:

Soil
Ground water
Surface water and sediment
Air
Food sources



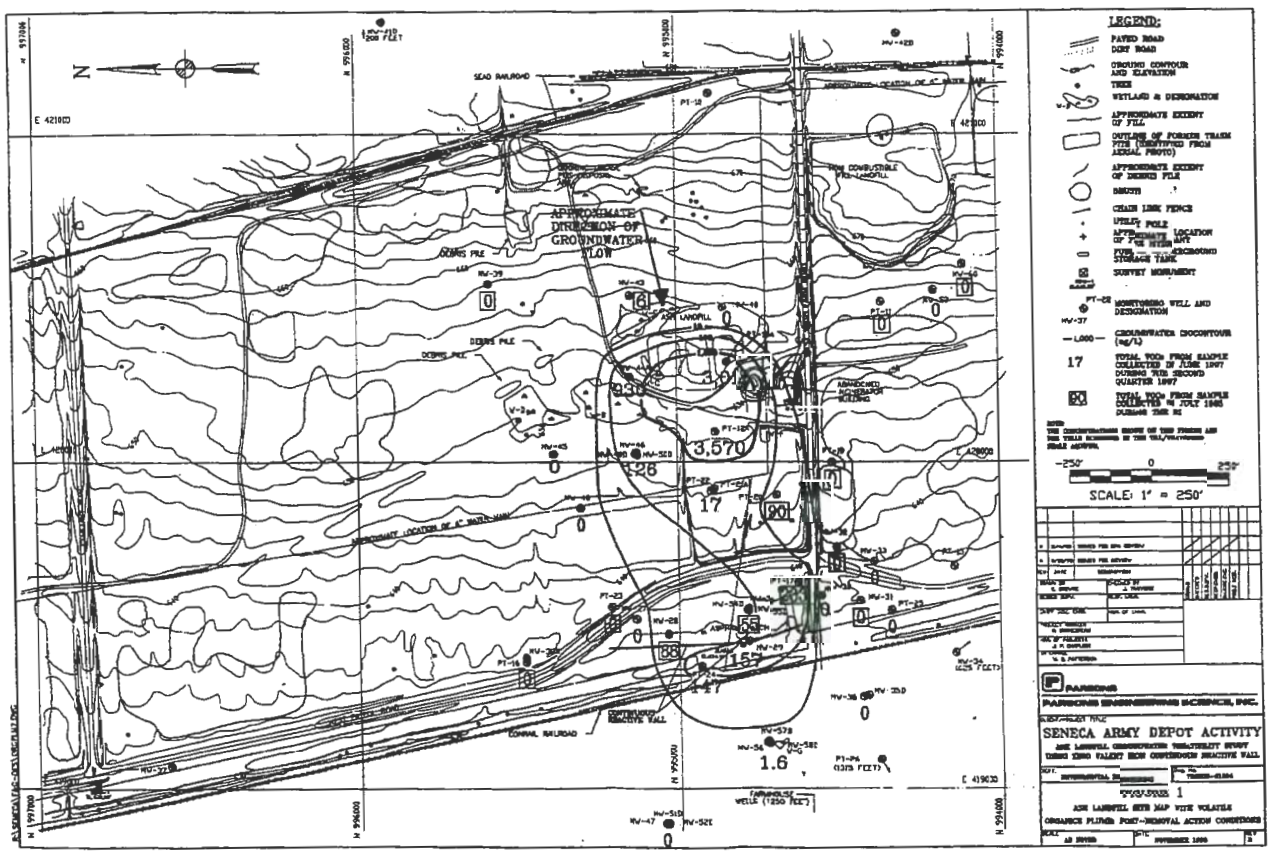
For Each Completed Exposure Pathway, Will the Contamination Affect Public Health?

ATSDR will evaluate existing data on contaminant concentration and exposure duration and frequency.

ATSDR will also consider individual characteristics (such as age, gender, and lifestyle) of the exposed population that may influence the public health effects of contamination.

Source: Parsons Engineering Science, Inc., 1998b

FIGURE 4. VOC Plume Associated with the Ash Landfill



APPENDIX

APPENDIX A. Glossary

Comparison Values
Estimated contaminant concentrations in specific media that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. The *comparison values* are calculated from the scientific literature available on exposure and health effects.

Concentration
The amount of one substance dissolved or contained in a given amount of another. For example, sea water contains a higher concentration of salt than fresh water.

Contaminant
Any substance or material that enters a system (e.g., the environment, human body, food) where it is not normally found.

Dermal
Referring to the skin. *Dermal* absorption means absorption through skin.

Environmental contamination
The presence of hazardous substances in the environment. From a public health perspective, *environmental contamination* is addressed when it potentially affects the health and quality of life of people living and working near the contamination.

Exposure
Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). *Exposure* may be short term (acute) or long term (chronic).

Ingestion
Swallowing (such as eating or drinking). Chemicals can get in or on food, drink, utensils, cigarettes, or hands where they can be ingested. After *ingestion*, chemicals can be absorbed into the blood and distributed throughout the body.

Media
Soil, water, air, plants, animals, or any other parts of the environment that can contain contaminants.

National Priorities List (NPL)
The Environmental Protection Agency's (EPA) listing of sites that have undergone preliminary assessment and site inspection to determine which locations pose immediate threats to persons living or working near the release. These are sites in need of cleanup.

Parts per billion (ppb)

a common basis of reporting water quality analysis. As an example, one ppb of trichloroethylene (TCE) equals one drop of TCE mixed in a competition-size swimming pool.

Parts per million (ppm)

a common basis of reporting soil analysis. For example, one part per million (ppm) of TCE equals one ounce of TCE in one million ounces of water.

Public Health Assessment

The evaluation of data and information on the release of hazardous substances into the environment for a specific site in order to assess any current or future impact on public health, develop health advisories or other recommendations, and identify studies or actions needed to evaluate and mitigate or prevent human health effects; also, the document resulting from the evaluation.

Plume

An area of chemicals in a particular medium, such as air or groundwater, moving away from its source in a long band or column. a *plume* can be a column of smoke from a chimney or chemicals moving with groundwater.

Potentially Exposed

The condition that exists if valid information, usually analytical environmental data, indicates the presence of contaminants of public health concern in one or more environmental media which humans contact (e.g., air, drinking water, soil, food chain, surface water), and there is evidence that some persons have an identified route of exposure (e.g., breathing contaminated air or drinking contaminated water).

Risk

In risk assessment, the probability that something will cause injury, combined with the potential severity of that injury.

Route of Exposure

The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different *routes of exposure* to contaminants that may be found in water.

Volatile Organic Compounds (VOCs)

Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen; these substances easily become vapors or gases. a significant number of the *VOCs* are commonly used as solvents (paint thinners, lacquer thinner, degreasers, and dry cleaning fluids).

APPENDIX B. Comparison Values

Comparison values are media-specific contaminant concentration that are used to select contaminants for further evaluation. The conclusion that a contaminant concentration exceeds the comparison does not mean that it will cause adverse health effects.

Cancer Risk Evaluation Guides (CREGs)

CREGS are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed over lifetime. ATSDR's CREGs are calculated from EPA's cancer potency factors.

Environmental Media Evaluation Guides (EMEGs)

EMEGs are based on ATSDR minimal risk levels and considers body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without noncarcinogenic health effects over a specified duration of exposure to include acute, intermediate, and chronic exposures.

Maximum Contaminant Level (MCL)

The MCL is the drinking water standard established by EPA for the maximum permissible level of a contaminant in water that is delivered to a free-flowing outlet. MCLs are considered protective of public health over a lifetime (70 years) for individuals consuming 2 liters of water per day.

Reference Media evaluation guides (RMEGs)

ATSDR derives RMEGs from EPA's oral reference doses. The RMEG represents the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects.