Public Health Assessment

Argonne National Laboratory, 317 Area

DuPage and Cook Counties, Illinois

Cass Avenue and Bluff Road

December 3, 2001

Prepared and Issued by the

Illinois Department of Public Health

Summary

The 317 Area of Argonne National Laboratory (ANL) poses no apparent public health hazard because ANL has restricted access, making public exposure to contaminants at the 317 Area unlikely.

ANL uses the 317 Area for temporary storage of radioactive material in shielded containers or in-ground concrete vaults. Some radioactive substances emit gamma radiation, which spreads in all directions. In the past, elevated gamma radiation levels were present near the ANL perimeter fence along the 317 Area. ANL has reduced the use of the 317 Area for radioactive storage through the demolition of several radioactive waste storage vaults. Consequently, gamma radiation should now be approaching background levels, essentially eliminating this pathway from future consideration.

ANL has not found elevated levels of radionuclides in soil around the ANL perimeter fence. ANL found soil contaminated with chemicals and radionuclides at the 317 Area, but they have removed most of this contaminated soil. Because of restricted access, any past exposure of the public to contaminated surface soil was probably infrequent and negligible. Past exposure of remediation workers to contaminated soil was infrequent and likely negligible.

Because exposure would have been occasional, past exposure to any contaminants in air would have been negligible. ANL monitoring did not find elevated airborne levels of radionuclides along the ANL perimeter fence. Past exposure to contaminants in sediments and surface water was also probably negligible. Exposure to groundwater contamination is not occurring and is unlikely to occur in the future.

Nearby residents are concerned about elevated rates of cancer because of radioactive contamination at ANL. Epidemiologic studies have not found elevated rates of cancer in the population near ANL.

Although no recommendations or follow-up health actions are indicated, IDPH will continue to provide concerned area residents with information about any public health concerns associated with ANL.

Purpose and Health Issues

The Illinois Environmental Protection Agency (IEPA) is overseeing remedial efforts at the Argonne National Laboratory (ANL) 317 Area under the corrective action requirements of the Resource Conservation and Recovery Act (RCRA). The Illinois Department of Public Health (IDPH) has received calls from concerned residents near ANL. Residents are concerned about increased cancer risks because of radioactive contamination at the various sites. This document provides responses to those concerns.

Background and Statement of Issues

Argonne National Laboratory (ANL)

ANL is near Lemont, Illinois (Figures 1 and 2). The facility has many areas with suspected or known releases of hazardous substances. The Illinois Environmental Protection Agency (IEPA) is addressing those source areas (sites) as part of the RCRA Part B Permit corrective action program.

ANL occupies the central 1,500 acres of a 3,740 acre property owned by the U.S. Government and DuPage County. ANL has been at this location since 1949 (Golchert and Kolzow 1994). ANL is a U.S. Department of Energy (DOE)-funded research facility operated by the University of Chicago. Current activities at ANL include the following (Golchert and Kolzow 1998; Golchert and Kolzow 1994):

1. nuclear energy,
    a. safety studies for light water and breeder reactors,
    b. component and material development for fission and fusion reactors, and
    c. immobilization of radioactive wastes for disposal;
2. medical radioisotope technology;
3. biological effects of low-level radiation;
4. superconductivity advances and applications;
5. design of synchrotron radiation accelerators;
6. development of electrochemical energy sources including fuel cells and batteries for vehicles and energy storage;
7. improvements in the use of coal for power production, especially high-sulfur coal;
8. evaluation of heat exchangers for the recovery of waste heat from engines; and
9. environmental activities,
    a. biological activity of energy-related mutagens and carcinogens,
    b. characterization and monitoring of energy-related pollutants, and
    c. effects of acid rain on soil, surface water, and vegetation.

ANL generated a Preliminary Assessment report in 1987 that identified 13 sites on the current ANL property with known or suspected hazardous substances: (1) 317 Area, (2) 319 Area, (3)

800 Area Landfill, (4) East Area Sewage Treatment Sand and Filter Beds, (5) Freund Ponds, (6) Wastewater Treatment Plants, (7) 570 Area Wastewater Sludge Drying Beds, (8) East Area Burn Pit, (9) Building 810, (10) Old Shooting Range at Building 832, (11) Building 34, (12) Building 330, and (13) 360 Area (Morris 1993).

Golchert and Kolzow (1998) listed three additional areas: the (1) 318 Area Gas Cylinder Disposal Area, (2) Gasoline Spill, Gasoline Station, and (3) Reactive Waste Disposal, Underwriters Pond, which is part of the Forest Preserve.

This document addresses only the 317 Area. Emissions from other sources at ANL are not within the scope of this report, although they contribute to off-site monitoring data interpreted in this document. Consequently, interpretation of off-site data includes all emissions from the facility.

The 317 Area

Starting in the late 1940s, ANL temporarily stored radioactive wastes at the 317 Area, which occupies about 8 acres in the southern part of ANL (Figures 2 and 3). ANL periodically shipped the wastes off the site for disposal. In the early 1950s, ANL built five underground, concrete vaults in the 317 Area. ANL stored containers of low and intermediate-level (transuranic) radioactive waste in four of these vaults. ANL mainly used a fifth vault, the deep vault, for intermediate-level radioactive waste. ANL kept small containers of highly radioactive material in another concrete structure known as the map tube facility. ANL stored steel bins of low-level radioactive waste awaiting off-site disposal in a large gravel-covered area north of the vaults (Morris 1993). Several recent changes have reduced the magnitude of waste storage in this area. All but one of the vaults are permanently closed and are either already demolished or are being decontaminated in preparation for demolition in 2002. A large number of portable waste bins have been shipped off site or moved to another interior location of ANL. These actions will minimize the amount of waste stored in the 317 Area in the near future.

Sumps collected water from footing drains of the vaults and discharged this water into a sewer system. This sewer system eventually discharged about 200 feet south of the perimeter fence, in the Waterfall Glen Forest Preserve. In 1986, monitoring conducted by ANL found small amounts of cesium-137, strontium-90, tritium, and volatile organic compounds (VOCs) in the discharged water. In early 1987, ANL blocked the discharge, permanently closed the sewer system, and periodically began removing water from the sumps. ANL analyzed this water for radioactivity before releasing it into the laboratory sewer system. After 1993, the sump water was discharged to the laboratory wastewater treatment system (Golchert and Kolzow 1998; Golchert and Kolzow 1995; Golchert 1990).

The 317 Area contained two concrete hazardous waste treatment facilities, the Shock Treatment Facility (also called the Shoot and Burn Pile) and the Alkali Metal Water Reaction Tank. ANL used the Shock Treatment Facility to treat reactive organic and inorganic chemicals. In total, ANL treated about 63 gallons of chemicals at this facility. ANL used the Alkali Metal Water

Reaction Tank to treat water-reactive metals. No wastes remain at either of those two facilities, which ANL cleaned and closed in 1994 (Moos 1997; Golchert 1990).

The 317 Area also contains the Bailer Building, a small building that ANL used to compact radioactive wastes. Later, ANL used the building to clean radioactive contamination off surfaces with a carbon dioxide pellet blaster. ANL cleaned equipment, lead bricks, and tools at this facility. ANL uses a concrete pad south of the bailer building to store containers of dry low-level radioactive mixed waste. This mixed waste will be relocated to another location of ANL well away from the fence line.

In the early 1950s, ANL built a french drain north of the vault area for disposal of undefined, non-radioactive liquid chemical wastes. The french drain had a corrugated steel pipe that emptied into an unlined pit filled with coarse gravel. ANL used this french drain for 4 to 5 years before replacing it with a french drain in the 319 Area (Morris 1993).

The Waterfall Glen Forest Preserve surrounds ANL. This forest preserve is part of the DuPage County Forest Preserve District. It contains a campground and trails for cross-country skiing, hiking, horseback riding, mountain-biking, and running. The Waterfall Glen Forest Preserve receives about 140,000 visitors annually (DuPage County Forest Preserve District 1997).

No people live within 1 mile of the 317 Area. ANL estimated that 5,137 people live within 2 miles, and 31,238 people live within 3 miles of the center of ANL (Golchert and Kolzow 1994).

Until December 1996, drinking water for ANL came from four on-site wells, none of which were downgradient of the 317 Area. In December 1996, ANL began using water from Lake Michigan (Golchert and Kolzow 1998). No private or municipal wells are down gradient of the 317 Area. All land between the 317 Area and the Des Plaines River is forest preserve property; therefore, residential or industrial development is unlikely. Consequently, no one is consuming or is likely to consume groundwater contaminated by the 317 Area.

Site Visits

IDPH staff conducted site visits of ANL on March 6, 1997, August 29, 1997, and May 20, 1999. Only four of the ANL sites, the 317 Area, 318 Area, 319 Area, and 800 Area, are visible from the site perimeter. A chain-link fence surrounds ANL, and barbed wire tops the fence. The fence has various signs prohibiting trespassing. Those signs identify the land as U.S. Government property or as operated by DOE. Guards staff all open gates to the facility.

The 317 Area is about a 40-minute walk from the nearest forest preserve parking lot. This includes a 10-minute walk down an unmarked side trail. On March 6, 1997, a chain-link fence surrounded the 317 Area. The fence had yellow radiation signs but was not topped with barbed wire. The 317 Area had several buildings and a crane control tower. A narrow unmarked trail of the Waterfall Glen Forest Preserve followed the perimeter fence along the 317 and 319 Areas.

On March 6, 1997, one set of boot prints was in the mud of this trail. On August 29, 1997, vegetation 4 to 5 feet tall had overgrown the trail along the fence by the 317 Area.

On May 20, 1999, a large fallen tree blocked the side trail that IDPH previously used to reach the 317 and 319 Areas. No paths led around the fallen tree. IDPH found another trail along a nearby power line right-of-way that also led to the perimeter fence. A trail led along the perimeter fence past the 317 Area. IDPH staff noted evidence of horseback riding along that trail. By May 20, 1999, ANL had demolished the crane control tower and three south vaults in the 317 Area. The Bailer Building, the two north vaults, an electrical box (pump station motor control center), and electrical wires remained. ANL also moved the south fence that had surrounded the 317 Area, thus reducing the size of the 317 Area. Construction equipment was present.

Discussion

Chemicals of Interest

The chemicals of interest at this site are radionuclides and some volatile organic compounds (VOCs). IDPH compared the maximum level of each contaminant detected during environmental sampling with appropriate screening comparison values, when available, to select chemicals of interest for further evaluation for both carcinogenic and non-carcinogenic health endpoints. Chemicals that exceeded comparison values and those for which no comparison value exists were selected for further evaluation. A detailed discussion of each of the comparison values used is found in Attachment 1.

The comparison values are used only to screen for contaminants that should be evaluated further and do not represent thresholds of toxicity. Though some of those chemicals might exist at levels greater than comparison values, the contaminants can only affect someone who is exposed and if the exposure results in high enough doses for adverse effects to occur. The amount of the contaminant, the duration and route of exposure, and the health status of exposed individuals are important factors in determining the potential for development of adverse health effects.

Environmental Contamination

Air

ANL has not measured the levels of non-radiological airborne contaminants inside the 317 Area; however, ANL has monitored the levels of airborne radionuclides around the perimeter fence. ANL did not detected elevated levels of airborne radionuclides (Golchert and Kolzow 1998; Golchert and Kolzow 1997; Golchert and Kolzow 1996; Golchert and Kolzow 1995; Golchert and Kolzow 1994; Golchert 1990). The levels of any non-radioactive chemicals are not known. The presence of vegetation and the management of contaminated soil have reduced the likelihood that airborne contaminants are present.

Biota

Food crops are not grown on any of the ANL sites, and ANL does not permit public hunting. ANL has a private deer harvesting program to prevent overpopulation and sends the meat from these deer to local food pantries. The Illinois Department of Nuclear Safety tests the deer meat for radionuclides before sending it to charity. In 1997, analysis of the deer meat found no radioactive contamination (Golchert and Kolzow 1998). Because this practice is occasional, the meat would be an insignificant part of the diet of any person.

Gamma Radiation

In the past, ANL found elevated gamma radiation levels along the perimeter fence of the 317 Area. In 1985, the gamma radiation level was 9.41 millisievert per year (mSv/yr). In 1997, that level was down to 1 mSv/yr, which is barely above background. With the demolition of several of the storage vaults and the reduction in the amount of stored radioactive waste, gamma radiation should now be approaching background levels.

Sediments

ANL sampled sediments in stream channels south of the 317 Area in the Waterfall Glen Forest Preserve. One possible source of contamination is the former outfall originating from vault footing drains in the 317 Area. Another possible source of contamination is groundwater movement from the 317 Area (Moos 1997). Analysis of sediments south of the 317 Area found no metals greater than state or regional background concentrations. ANL found low concentrations of cesium-137, cobalt-60, and PCBs (Moos 1997), but those levels did not exceed comparison values.

Soil

Initial ANL soil sampling found that several feet of clean soil covered all contaminated soil in the 317 Area (Golchert 1990). Follow-up soil sampling found one location with low levels of PCBs (Moos 1997). The levels were below comparison values and were not of health concern for on-site workers. Sampling within 20 feet of the vaults found localized contamination with cesium-137 and cobalt-60. ANL removed this radioactively-contaminated soil (Golchert and Kolzow 1996). Past exposure of on-site workers to this localized contamination would have been occasional and resulted in no increased risk of cancer. ANL has not found elevated levels of radionuclides in soil around the perimeter fence.

Surface Water

Until 1987, contaminated water from sumps in the 317 Area discharged into a stream south of the 317 Area. Because this stream is in the Waterfall Glen Forest Preserve, past skin contact with the water is possible. The dermal contact would have been occasional, resulting in a negligible exposure.

ANL sampled surface water from a seep in the Waterfall Glen Forest Preserve, south of the 317 Area. That seep water probably originated from contaminated groundwater at the 317 Area. ANL also sampled stream water upstream and downstream from the seep (Moos 1997). Water quality in the stream was similar upstream and downstream of the seep, suggesting that the seep did not adversely affect water quality. Although ANL found contaminants in the seep water, no one consumes this water. Occasional skin contact of this water by park visitors or remediation workers would not be a health hazard.

Exposure Analysis

A hazardous chemical can affect people only if they contact it through an exposure pathway at a sufficient level to cause a toxic effect. The five components of an exposure pathway are (1) a source of exposure; (2) an environmental transport medium; (3) a point of exposure; (4) a route of exposure; and (5) an exposed population. An exposure pathway is complete if all its components are present and exposure occurred in the past, is occurring, or will occur in the future. An exposure pathway is potential if parts of a pathway are absent, data are insufficient to decide whether it is complete, or exposure may occur at some time (past, present, future). An exposure pathway is incomplete if part of it is not present and will never exist.

Completed Exposure Pathways

Gamma Radiation

Everyone is exposed to background levels of alpha, beta, and gamma radiation, which originate from naturally-occurring radionuclides in the environment (Figure 4). Human-generated sources, mainly medical in nature, also contribute. Above average radiation exposure occurs in people who receive repeated x-rays or radiation therapy. In addition, smokers expose their lungs to radiation levels up to 56 times background. That is because tobacco plants accumulate naturally occurring polonium-210, which is present in the smoke (BEIR V 1990).

Exposure to alpha or beta radiation requires ingestion, inhalation, or skin contact with a radionuclide. In contrast, gamma radiation can travel easily through the air. Gamma radiation spreads in all directions from a source, and exposure dose depends on time, distance, and shielding. It can pass through a large amount of low-density material without losing much energy (Charp 1992); however, it can lose much of its energy in thin layers of high-density material (Jensen 1992). Exposure to gamma radiation decreases as the distance from a source increases.

ANL has restricted access; therefore, public exposure at the 317 Area is unlikely. Past exposure of park visitors at the perimeter fence probably was infrequent, resulting in negligible exposure. Golchert and Kolzow (1998) estimated that a person spending 10 minutes per week near the perimeter fence of the 317 Area would receive a radiation dose of 0.0002 mSv. That exposure is a very small fraction of the 3.6 mSv of radiation that the average American receives each year from natural sources. Demolition of the vaults and the removal of radioactively-contaminated soil and waste will essentially eliminate this pathway for the future.

Potential Exposure Pathways

Air

ANL has not found elevated levels of airborne radionuclides near the perimeter fence. The possible presence of any other airborne contaminants is unknown. In the past, vegetation at the 317 Area would have reduced the production of airborne dust. Remediation workers might inhale on-site contaminants. Because of restricted access, any public exposure is more likely outside the perimeter fence. Because exposure would have been occasional, past exposure of park visitors or workers to possible airborne contaminants was probably negligible. The removal of contaminated surface soil essentially has eliminated this pathway for the future.

Community Health Concerns

Community concerns about ANL, voiced at a September 17, 1991, public meeting organized by the citizen group Kingery East Citizen's Advisory Committee included: (1) the contamination of plants, soil, rivers, and sewers; (2) the presence of americium, neptunium, plutonium, and uranium in groundwater; (3) increased rates of cancer (especially leukemia from strontium-90 and ovarian cancer); and (4) learning disabilities from exposure to contaminants.

On February 21, 1997, the group expressed concern about the past airborne dispersal of radioactive chemicals downwind of ANL. The group was concerned that the radiation might have caused elevated cancer rates in Burr Ridge, Clarendon Hills, Darien, Willowbrook, and Willow Springs. One concern was that airborne emissions might have been higher in the past. They also expressed concern that past airborne emissions from ANL have contaminated soils with radionuclides in downwind residential areas.

Response to Community Concerns for the 317 Area

The presence of contaminants does not mean that they pose a threat to public health. For health effects to occur, chemical exposure must be at high enough levels and for a sufficient period. At the 317 Area, because of the low levels of contaminants and the infrequent opportunity for exposure, people should not experience adverse health effects.

ANL has restricted access, which makes on-site exposure of the public unlikely. No one is drinking contaminated groundwater at ANL and no wells used for human consumption exist downgradient of any of the areas with known groundwater contamination (including the 318 Area). All land between the 317 Area and the Des Plaines River is forest preserve, so future residential, business, or industrial development is unlikely. Consequently, the known groundwater contamination at ANL is not a health hazard.

From at least 1989 to the present, the exposure of residents around ANL to airborne radionuclides has been negligible. Exposure of on-site workers may have occurred, but because monitoring data are unavailable, IDPH cannot evaluate any past health risks. Past ANL

emissions have not caused elevated radionuclide levels in surface soil around the facility perimeter. Consequently, the soil of more distant downwind residents also should not be contaminated.

Health professionals cannot distinguish chemically or radiologically induced cancers from cancers that occur spontaneously. Other risk factors such as occupational, medical, lifestyle, heredity, environmental factors, are usually unknown. Researchers use state cancer registry data to compute population-based rates of cancer to evaluate whether the rate of cancer is elevated in a specific area. They then compare the rate of cancer in an exposed, or possibly exposed, population to the expected cancer rate in a similar, unexposed population.

The IDPH Division of Epidemiologic Studies has conducted five cancer incidence data reviews (by zip code) of people living in different areas near ANL. Those were (1) Bolingbrook and Lemont (IDPH 1991a), (2) Clarendon Hills (IDPH 1995), (3) Darien and Westmont (IDPH 1996), (4) Willow Springs (IDPH 1993), and (5) Woodridge (IDPH 1991b). These cancer incidence data reviews found no evidence of increased cancer rates in communities around ANL.

Child Health Initiative

IDPH recognizes that children can be especially sensitive to exposure to some contaminants and to physical hazards at hazardous waste sites. For that reason, IDPH always considers children when evaluating possible human exposures. In this case, no children are being exposed to contamination at the 317 Area because the contamination is not present off site. Children might have been exposed for very short periods of time in the past if they wandered onto trails that passed by the 317 Area. If that happened, the exposure dose children might have received should not have been high enough for a long enough period of time to have caused any adverse health effects.

Conclusions

The 317 Area poses no apparent public health hazard because ANL has restricted access, making public exposure to contaminants at the 317 Area unlikely.

In the past, elevated gamma radiation levels were present near the ANL perimeter fence along the 317 Area. However, the exposure of park visitors and ANL workers likely was negligible. ANL has greatly reduced the use of the 317 Area for radioactive storage and removed much of the contaminated radioactive soil during demolition of the vaults. Consequently, gamma radiation should now be approaching background levels, thereby eliminating this exposure pathway.

ANL has not found elevated levels of radionuclides in the air or soil around the ANL perimeter fence. Because of restricted access, past exposure of the public to contaminated on-site surface soil probably was minimal. Past exposure of remediation workers to contaminated soil probably also was infrequent. ANL has removed most of this contaminated soil. Past exposure to

contaminants in sediments and surface water also would have been negligible. Exposure to groundwater contamination is not occurring and is unlikely to occur in the future.

IDPH conducted cancer incidence data reviews for communities in the area. No increased cancer incidence was found.

Recommendations and Public Health Actions

Although no further recommendations or follow-up health actions are indicated, IDPH will continue to provide information to concerned area residents about public health issues associated with ANL.

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Figures

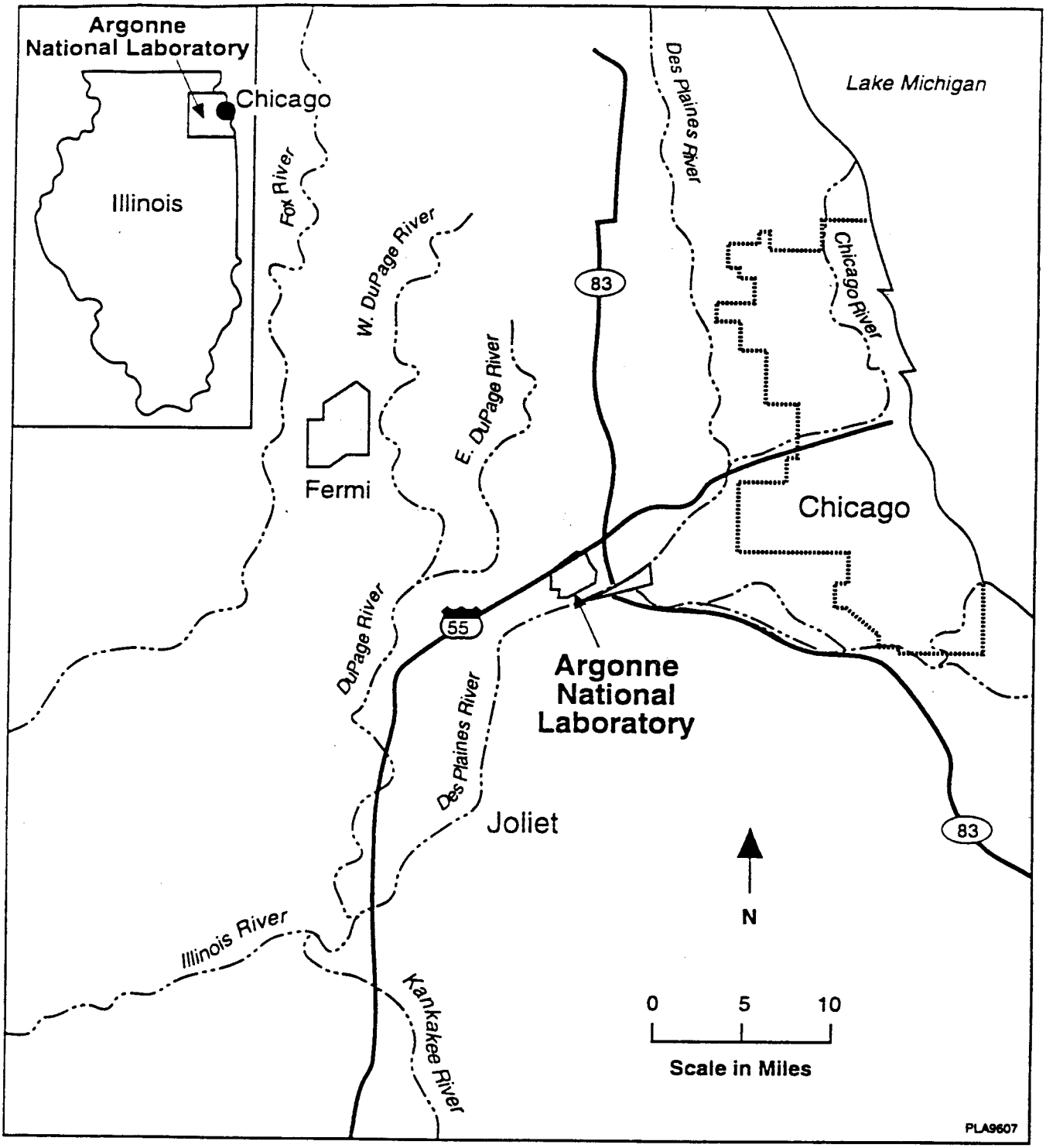
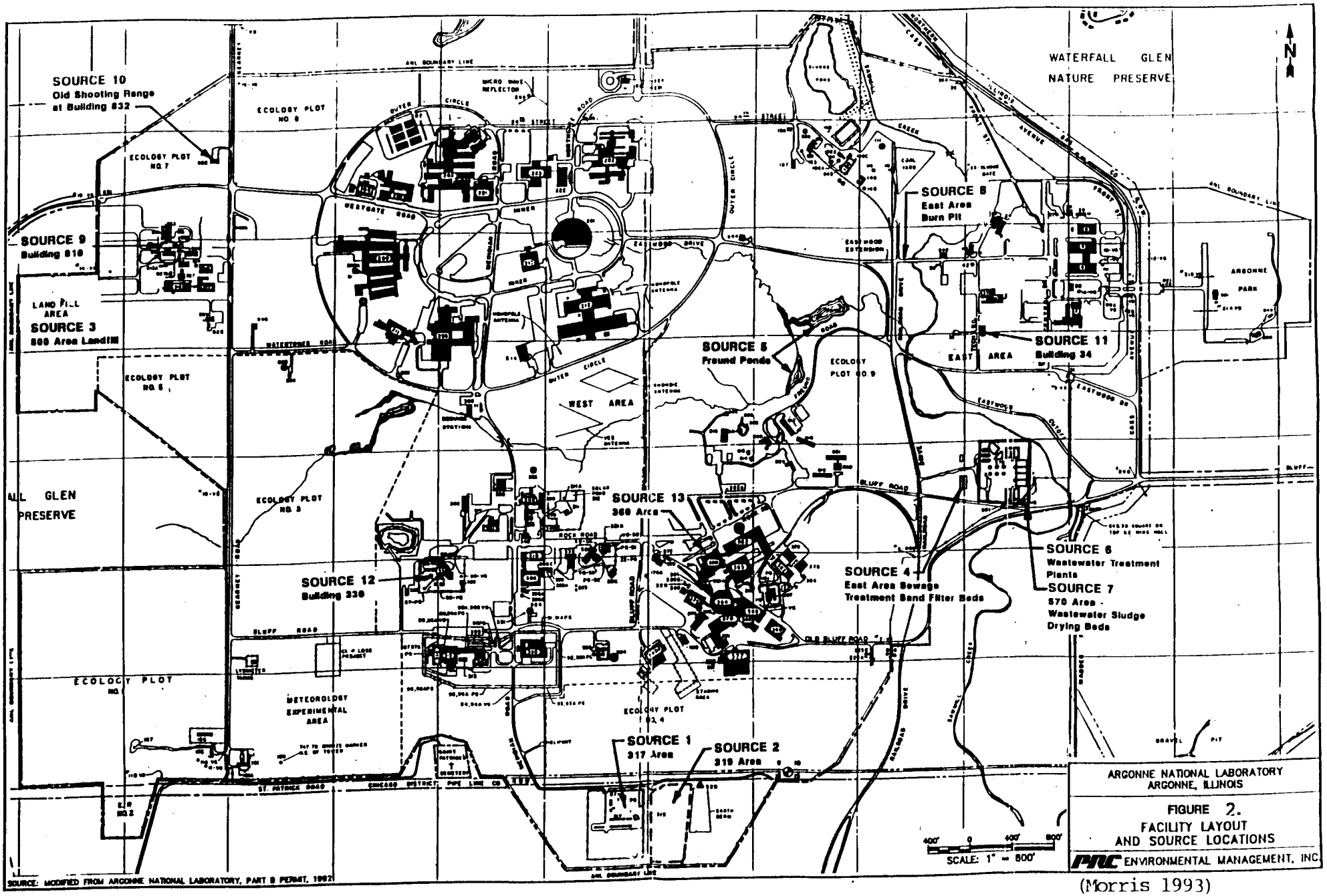


FIGURE 1. Location of Argonne National Laboratory

(Moos 1997)


SOURCE 10
Old Shooting Range
at Building 832
SOURCE 9
Building 810
LAND FILL
AREA
SOURCE 3
800 Area Landfill
SOURCE 5
Freund Ponds
SOURCE 8
East Area
Burn Pit
SOURCE 11
Building 34
SOURCE 13
300 Area
SOURCE 12
Building 330
SOURCE 4
East Area Sewage
Treatment Sand Filter Beds
SOURCE 6
Wastewater Treatment
Plants
SOURCE 7
570 Area -
Wastewater Sludge
Drying Beds
SOURCE 1
317 Area
SOURCE 2
319 Area
WATERFALL GLEN
NATURE PRESERVE
ALL GLEN
PRESERVE
WEST AREA
EAST AREA
METEOROLOGY
EXPERIMENTAL
AREA
ECOLOGY PLOT
NO. 1
ECOLOGY PLOT
NO. 2
ECOLOGY PLOT
NO. 3
ECOLOGY PLOT
NO. 4
ECOLOGY PLOT
NO. 5
ECOLOGY PLOT
NO. 6
ECOLOGY PLOT
NO. 7
ECOLOGY PLOT
NO. 8
ECOLOGY PLOT
NO. 9
ARGONNE
PARK
BLUFF ROAD
OLD BLUFF ROAD
ROCK ROAD
WESTGATE ROAD
EASTWOOD DRIVE
OUTER CIRCLE
INNER CIRCLE
ST. PATRICK ROAD
CHICAGO DISTRICT PIPE LINE CO
ANL BOUNDARY LINE
N
400' 0 400' 800'
SCALE: 1" = 800'
ARGONNE NATIONAL LABORATORY
ARGONNE, ILLINOIS
FIGURE 2.
FACILITY LAYOUT
AND SOURCE LOCATIONS
ENVIRONMENTAL MANAGEMENT, INC.
SOURCE: MODIFIED FROM ARGONNE NATIONAL LABORATORY, PART B PERMIT, 1992

(Morris 1993)

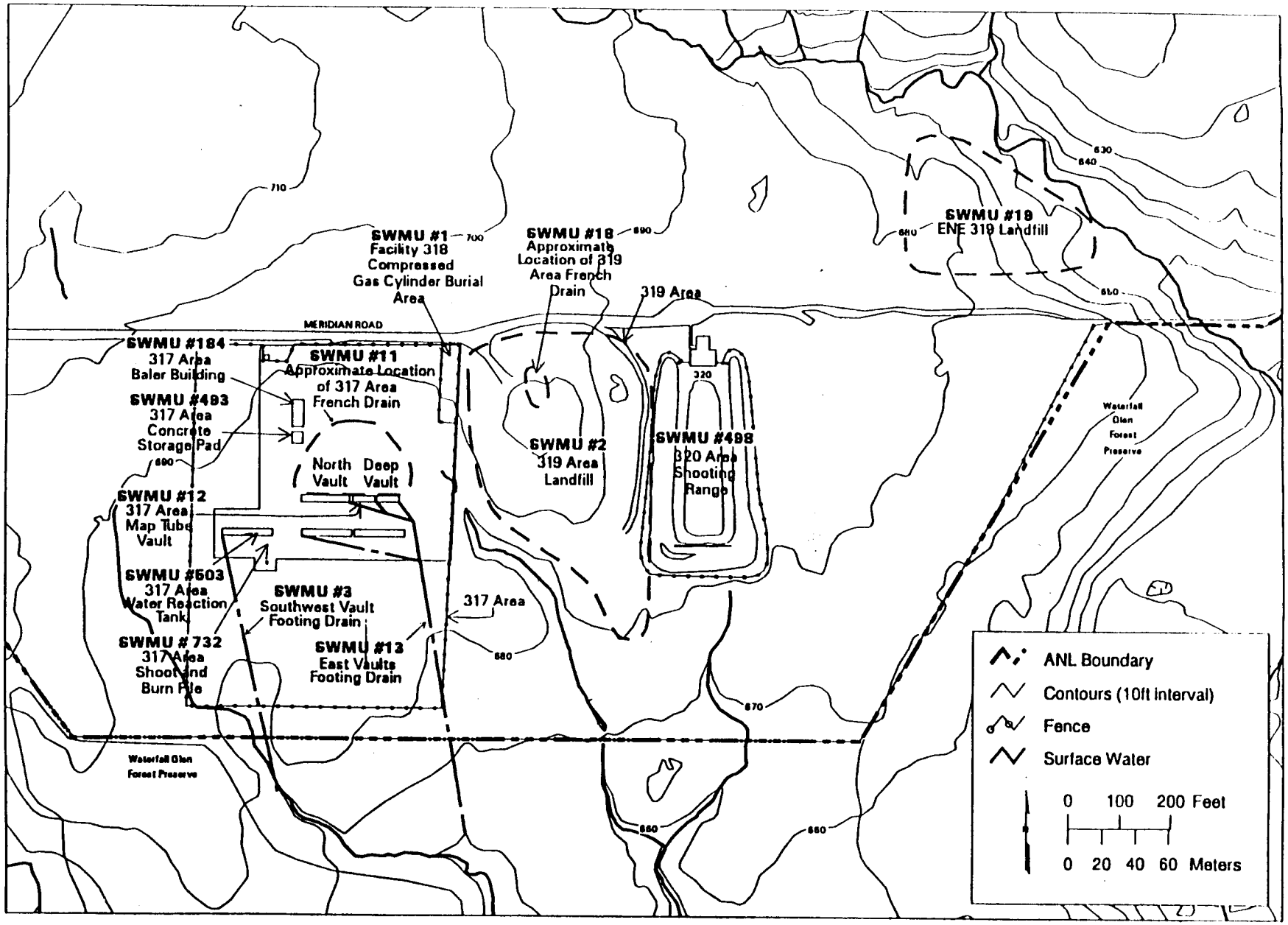


FIGURE 3. Locations of the SWMUs in the 317/319/ENE Area

(Moos 1997)

Attachment

Attachment 1

Comparison Values Used In Screening Contaminants For Further Evaluation

Environmental Media Evaluation Guides (EMEGs) are developed for chemicals based on their toxicity, frequency of occurrence at National Priority List (NPL) sites, and potential for human exposure. They are derived to protect the most sensitive populations and are not action levels, but rather comparison values. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Reference Dose Media Evaluation Guides (RMEGs) are another type of comparison value derived to protect the most sensitive populations. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations based on a probability of one excess cancer in a million persons exposed to a chemical over a lifetime. These are also very conservative values designed to protect sensitive members of the population.

Maximum Contaminant Levels (MCLs) have been established by USEPA for public water supplies to reduce the chances of adverse health effects from contaminated drinking water. These standards are well below levels for which health effects have been observed and take into account the financial feasibility of achieving specific contaminant levels. These are enforceable limits that public water supplies must meet.

Lifetime Health Advisories for drinking water (LTHAs) have been established by USEPA for drinking water and are the concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects over a lifetime of exposure. These are conservative values that incorporate a margin of safety.