**Final Release** 

**Public Health Assessment** 

# **Palos Forest Preserve – Argonne Plot M**

# **Cook County, Illinois**

107<sup>th</sup> and Archer Avenue

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Prepared and Issued by the

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### **Summary**

Palos Forest Preserve – Argonne Plot M poses no apparent public health hazard because human exposure to contaminants is infrequent, of short duration, and likely negligible.

Plot M is at the former location of Argonne National Laboratory and its predecessor, the University of Chicago Metallurgical Laboratory. Plot M is a 150 foot by 140 foot area that Argonne Site A used for the burial of radioactive and chemical wastes.

The past occasional use of wells in the Red Gate Woods Picnic Area does not pose a risk to public health from radionuclide exposure. Elevated levels of metals also were detected in the wells. The metals in the Red Gate Woods wells probably did not come from Plot M, but may have originated from plumbing. The wells are not currently being used since they were taken out of service due to fecal coliform contamination unrelated to Plot M. People may consume this water in the future if the Cook County Forest Preserve District again makes these wells usable by park visitors.

Near Plot M, the exposure of park visitors to chemicals and radionuclides in air, sediments, and surface water is infrequent, of short duration, and likely negligible. Eating fish from the Illinois and Michigan Canal should not result in exposure to elevated radionuclide concentrations, although possible non-radioactive contaminants are unknown.

Before the site was capped in 1956, on-site workers may have been exposed to unknown radioactive and non radioactive contaminants in air and soil at levels of concern. They also may have been exposed to elevated levels of gamma radiation; however, the Illinois Department of Public Health cannot reconstruct these exposures.

Nearby residents are concerned about elevated cancer rates because of radioactive contamination at Plot M. Several epidemiologic studies have found no elevated cancer rates in people living near Plot M.

### Purpose

The Illinois Department of Public Health (IDPH) has received calls from concerned residents near Palos Forest Preserve – Argonne Plot M. Residents are concerned about increased cancer risks because of radioactive contamination at Plot M. Monitoring activities at Plot M are the responsibility of the U.S. Department of Energy (DOE).

### **Background and Statement of Issues**

Plot M and Site A (Figures 1 and 2) are in the Palos Forest Preserve and are part of the former location of Argonne National Laboratory (ANL) and its predecessor, the University of Chicago Metallurgical Laboratory. The Palos Forest Preserve is discontinuous and covers about 67,000 acres (1) (2) (3). Site A is a 19-acre area that had experimental laboratories and two nuclear reactors. Plot M is a 150 foot by 140 foot area that Site A used for the burial of radioactive wastes. The past and present owner of this land is the Cook County Forest Preserve District (CCFPD).

Plot M and Site A were part of the World War II Manhattan Engineering District Project, which made the first atomic bomb. Site A operated from 1943 to 1954, and research programs included:

- C reactor control, operation, and physics studies,
- C fission product separations,
- C plutonium 239 production and separation from irradiated fuel,
- C radionuclide metabolism in laboratory animals,
- C studies of radiation protection and shielding, and
- C tritium recovery from irradiated lithium.

Two nuclear reactors, including the first reactor ever made, operated at the site. One reactor used air for cooling, by natural ventilation. The other reactor used heavy water for cooling. Both reactors used cadmium and lead for shielding (2)(3).

From 1944 to 1948, radioactive wastes and contaminated laboratory equipment from Site A were buried in Plot M. Until 1948, they buried wastes in 6-foot deep trenches and covered the wastes with soil. Starting that year, they buried wastes in steel bins. In 1949, steel bins were removed from Site A and sent to Oak Ridge National Laboratory. Records of the items placed in Plot M are incomplete, but known items include animal carcasses, building debris, clothing, contaminated equipment, radioactive materials, and some hazardous materials like lead. In 1956, 8-foot deep concrete side walls were poured around the perimeter of Plot M and a 1-foot-thick reinforced concrete slab was poured over the top. Finally, the slab was covered with about 2 feet of soil and seeded with grass (3).

Plot M is near the Red Gate Woods Picnic Area that uses several groundwater wells as a source of drinking water (Figure 2). In 1973, tritium was found in some wells at the picnic area. ANL later found that the source of this contamination was Plot M.

In 1988, because of fecal coliform contamination in well 5167, ANL installed a replacement well (5160) at the Red Gate Woods Picnic Area, which was removed from service in 1999 due to fecal coliform. In 1991, also because of fecal coliform contamination, CCFPD took picnic wells 5158 and 5159 out of service (2)(3). The fecal coliform contamination probably originated from a malfunctioning septic system in the Red Gate Woods Picnic Area. The fecal coliform was definitely not from Plot M or Site A. Fecal coliform are bacteria present in human and animal excrement.

### **Demographics**

According to U.S. Bureau of the Census data, about 500 people live within 1 mile of Plot M and Site A. Figure 3 shows the demographic profile.

### Site Visits

IDPH staff conducted site visits of Plot M on March 6, 1997, August 29, 1997, and May 20, 1999. An extensive network of cross-country skiing, hiking, horseback riding, and mountain bike trails crisscross the Palos Forest Preserve. One trail leads from the Red Gate Woods Picnic Area, past several monitoring wells, and over the center of Plot M. During all site visits, IDPH staff observed footprints on the trail.

On March 6, 1997, informational signs were posted in the Red Gate Woods Picnic Area that described the history of Plot M and Site A. By August 29, 1997, CCFPD had removed these signs.

The center of Plot M has a large concrete block with "DO NOT DIG" in large letters. The block describes the past burial of radioactive materials and that the burial area extends 100 feet in each direction from the sides of the concrete block. The block also states that the buried materials do not pose a threat to park visitors. By August 29, 1997, someone had vandalized the block by removing the "no" from "poses no danger to park visitors."

On May 20, 1999, small boxelder trees were growing on the northwestern corner of the cap. The wind easily knocks over boxelder trees when mature, and this may expose the concrete of the cap. During this site visit IDPH observed only one public well at the Red Gate Woods Picnic Area. CCFPD had removed its handle and had padlocked its pumping mechanism.

# Discussion

### **Chemicals of Interest**

The chemicals of interest at this site are radionuclides, cadmium, lead, manganese, and zinc. 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 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

In 1990, ANL measured the airborne tritium concentrations in water vapor above a small intermittent stream near Plot M. Upstream from Plot M (location 1, Figure 4), ANL detected tritium only once, at 0.02 becquerels per cubic meter (Bq/m<sup>3</sup>). Downstream from Plot M (location 9, Figure 4), the tritium concentration ranged from non-detectable to 0.29 Bq/m<sup>3</sup>. Elevated downstream tritium concentrations occasionally occurred when the stream was dry.

# Groundwater

In 1990 and 1998, ANL sampled groundwater from shallow (25 to 40 feet deep), intermediate (60 feet deep), and deep (110 to 127 feet deep) on-site and off-site monitoring wells. Two of the shallow on-site wells are at an angle that allows groundwater to be sampled directly under the wastes. The off-site wells are between Plot M and the Red Gate Woods Picnic Area. ANL analyzed the water for radionuclides, organic compounds, and inorganic compounds.

Radionuclides detected in the water samples at elevated levels included tritium and strontium 90 (Table 1). Very low levels of organic chemicals were also detected in monitoring wells upgradient and downgradient from Plot M; however, they did not exceed comparison values. No inorganic chemicals were found at elevated levels in the monitoring wells.

In 1973, ANL found tritium greater than background levels in two public wells at the Red Gate Woods Picnic Area. According to DOE, the Red Gate Woods Picnic Area wells have been sampled annually for radionuclides and inorganic chemicals for the past 20 years. No radionuclides were found in recent sampling, but cadmium, lead, manganese, and zinc were detected at elevated levels (Table 2).

In 1998, ANL also sampled four private wells near 107<sup>th</sup> and Archer Avenue, west of the site. No chemicals were found at levels greater than comparison values (1).

# Sediments

In 1990 and 1998, ANL sampled sediments from the intermittent stream near Plot M and analyzed them for radionuclides (1) (3). No radionuclides exceeded a level two times the regional background level as reported by Golchert and Kolzow (4).

### **Surface Water**

In 1990, ANL sampled surface water from the intermittent stream near Plot M and analyzed the water for tritium (Table 3; Figure 4 gives sampling locations). The highest concentration of tritium was by the seep next to Plot M. ANL also found elevated levels of tritium downstream from Plot M, although they decreased with the distance downstream. This stream empties into the Illinois and Michigan Canal. DOE sampled the water of the canal and did not find elevated levels of tritium (5).

In 1998, ANL sampled surface water from the intermittent stream by Plot M and found lower concentrations of tritium than in 1990 (Table 4). They also found slightly elevated uranium and strontium 90 concentrations downstream from Plot M.

### **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**

### Groundwater

The geology of a site controls the flow of groundwater. Groundwater easily flows through sand and gravel, but not clay. Before the concrete cap was placed on Plot M in 1956, precipitation may have dissolved contaminants and transported them to groundwater. Currently at Plot M, the concrete cap should prevent this; however, groundwater contamination could still occur if movement carries groundwater into the wastes. Near Plot M, groundwater flows mainly to the north. ANL is uncertain whether the present groundwater contamination originated from infiltrating precipitation before the site was capped, or from groundwater migrating through the site (1) (3). In the future, if weathering or excavation compromises the integrity of the cap, precipitation again may move through the wastes. This could increase the levels of contaminants in groundwater. The Red Gate Woods Picnic Area wells draw water from the shallow dolomite aquifer, which is close to the land surface at that point. No other private or public wells use groundwater downgradient from Plot M (2) (3). In the past, people drank water from wells of the Red Gate Woods Picnic Area, but that use probably was occasional. In 1991, CCFPD took these wells out of service because of fecal coliform contamination.

The amount of radioactive materials in Plot M will decrease with time as the radioactive materials decay. This is particularly true for tritium and strontium 90. The nuclear reactors at Site A that produced these radionuclides have not been active for many years. Tritium was detected in the wells at the Red Gate Woods Picnic Area, but not at a level that would be expected to cause adverse health effects. Currently, no one is consuming the water since CCFPD has taken the wells out of service.

The wells at the Red Gate Woods Picnic Area also have elevated levels of cadmium, lead, manganese, and zinc. These metals were not found at elevated levels in the monitoring wells between Plot M and the Red Gate Woods Picnic Area, so it is not likely that they migrated from Plot M (1). Lead and zinc may originate from plumbing. Manganese is a component of the dolomite aquifer, but the source of cadmium is not known.

In the past, visitors may have been exposed to elevated levels of these metals in water. They take time to leach out of plumbing components, so elevated levels should occur only in water that has sat in the pipes for many hours. Running the water until it is cold flushes the pipes and normally reduces the level of metals in the water. When park visitors used the pumps, exposure to high metal concentrations depended upon the daily use rate and the flushing of the plumbing.

Currently, no one is drinking water from the Red Gate Woods Picnic Area wells. If CCFPD fixes the septic system of the Red Gate Woods Picnic Area restrooms, they may reopen the wells for public use. Park visitors could then be exposed to the elevated levels of metals from the plumbing.

### **Potential Exposure Pathways**

### Air

Elevated tritium levels were found along an intermittent stream flowing near Plot M; however, exposure along this stream probably is occasional, likely resulting in negligible exposure.

Vegetation reduces the production of airborne dust. The concrete, soil, and grass-covered cap of Plot M should prevent the production of contaminated airborne dust and should reduce the release of gases.

### Biota

Food crops are not grown at or near Plot M, and people cannot hunt at or near Plot M. Therefore, this document will not discuss the consumption of food crops or wild game.

People reportedly fish in the Illinois and Michigan Canal, north of Plot M. ANL found no radioactive contamination originating from the site in sediments of the intermittent stream by Plot M that flows into the canal. Surface water of the canal does not contain elevated levels of tritium but there is tritium in the water naturally, so fish should not have elevated concentrations of radionuclides.

### Sediments

Contaminated groundwater originating from Plot M discharges through a seep into a nearby intermittent stream. This stream runs from its origin near Site A, past Plot M, near the Red Gate Woods wells, and ultimately discharges into the Illinois and Michigan Canal. Currently, the sediments do not contain elevated levels of radionuclides. Exposure to any contaminated sediments in this stream would be occasional, resulting in negligible exposure.

### Soil

The concentrations of radioactive and non-radioactive chemicals under the concrete cap of Plot M are unknown. Before installation of the concrete cap, on-site workers probably were exposed to on-site surface soil; however, IDPH cannot evaluate this past exposure. Currently, the concrete cap prevents exposure to contaminated soil, but future disturbance of the cap could expose buried contaminants and result in exposure.

### **Surface Water**

A groundwater seep near Plot M has contaminated an intermittent stream. Surface water in the vicinity is not used for municipal water. Visitors may be exposed to contaminated surface water through skin contact. Children and adults hiking through the streams could contact contaminants in water, but contact should be infrequent resulting in negligible exposure.

# **Public Health Implications**

Based on the available data, IDPH expects no adverse health effects from exposure to site-related contaminants. Elevated levels of cadmium, lead, manganese, and zinc are present in wells of the Red Gate Woods Picnic Area, but these are currently not being used. For estimating past and future exposure to park visitors drinking water from the Red Gate Woods Picnic Area, IDPH used an exposure scenario of a 10-kilogram child ingesting l liter of water per day for 30 days per year.

### **Toxicologic Evaluation**

### Cadmium

Based on the above exposure scenario, the levels of cadmium found in the Red Gate Woods Picnic Area wells would not cause adverse health effects for children or adults (6).

### Lead

Lead concentrations in the Red Gate Woods wells exceeded the USEPA Action Level; however, based on the exposure scenario above, IDPH expects no adverse health effects for park visitors (7).

### Manganese

Based on the above exposure scenario, consumption of manganese in water from the Red Gate Woods wells should not cause adverse health effects for children or adults (8).

### Zinc

The picnic wells at the Red Gate Woods Picnic Area have high concentrations of zinc; however, no adverse health effects would be expected based on the given exposure scenario (9).

### Radionuclides

Groundwater at Plot M is contaminated with tritium and strontium 90. Strontium 90 was found only in the monitoring wells at Plot M and no one is currently drinking water contaminated with strontium 90.

Tritium was found in the Red Gate Woods Picnic Area wells. ANL estimated if a person drank Red Gate Woods well water as their sole source of drinking water and breathed air with the maximum concentration of tritium found by the stream near Plot M, their annual radiation dose would be 0.00011 milliSieverts (mSv) (3). This is about 0.003 percent of the average American exposure to natural background radiation, 3.6 mSv (including radon). Exposure of park visitors would be much less. Consequently, IDPH expects no adverse health effects from radionuclides at Plot M.

# **Community Health Concerns**

On September 17, 1991, a public meeting was held to discuss the contamination at Plot M and Site A. At the meeting, the citizens group, Kingery East Citizen's Advisory Committee, voiced their health concerns. These concerns included:

- C the contamination of plants, soil, rivers, and sewers,
- C the presence of americium, neptunium, plutonium, and uranium in groundwater,
- C contamination in Red Gate Woods outside Plot M and Site A,
- C increased rates of cancer (especially leukemia from strontium 90 and ovarian cancer), and
- C whether learning disabilities could be linked to exposure to contaminants.

This group has also expressed concern that Red Gate Woods is open to the public, so human exposure to contaminants may occur. On February 21, 1997, this group expressed concern about possible radioactive contamination in fish of the Illinois and Michigan Canal. They also were concerned about public use of wells in the Red Gate Woods Picnic Area.

#### Response to Community Concerns for Plot M and the Red Gate Woods Picnic Area

The presence of contaminants does not mean that they pose a health hazard. For health effects to occur, exposure to contaminants must be at high enough levels and sufficient frequency and duration. At Plot M, because of the concentrations of contaminants and the infrequent nature of exposure, IDPH does not expect adverse health effects from exposure to site-related contaminants.

Airborne emissions from Plot M may have been higher in the past and on-site workers, in particular, may have been exposed to elevated levels of contaminants; however, because monitoring data are unavailable, IDPH cannot determine whether the levels were high enough to cause adverse health effects.

Health professionals cannot distinguish chemically or radiologically induced cancers from cancers that occur spontaneously. Other risk factors such as occupational, medical, lifestyle, heredity, and 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, Site A, and Plot M. Those were Bolingbrook and Lemont (10), Clarendon Hills (11), Darien and Westmont (12), Willow Springs (13), and Woodridge (14). These cancer incidence data reviews found no evidence of increased cancer rates in communities around ANL.

Using the Red Gate Woods Picnic Area as a park does not pose a threat to public health. Although elevated levels of some metals were found in the Red Gate Woods Picnic Area wells in the past, the chemicals were not found at levels that would be expected to cause adverse health effects and currently the wells are not being used.

The concentrations of chemicals in fish of the Illinois and Michigan Canal are unknown. Seepage from Plot M has contaminated an intermittent stream that flows into the canal. Therefore, it is possible that fish in this area are contaminated. DOE found that tritium in the Illinois and Michigan Canal did not exceed background levels (5). However, the concentrations of non-radioactive chemicals in the stream by Plot M are unknown.

### **Public Comment Period**

This public health assessment was made available for public comment from October 20 to December 6, 2002. No public comments were received.

### **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. Children may have been exposed to contaminants in the past if they visited the park, but the amount children might have received should not have been high enough for a long enough period to have caused any adverse health effects.

# Conclusions

Based on all available information, IDPH concludes that under current conditions exposures at Plot M are not at levels that would be expected to cause adverse health effects and therefore the site does not pose a public health hazard. Exposure of park visitors to chemicals and radionuclides in the air, sediments, and surface water near Plot M is infrequent and of short duration. Eating fish from the Illinois and Michigan Canal should not result in elevated radionuclide exposure.

Before the site was capped in 1956, on-site workers may have been exposed to unknown radioactive and non-radioactive contaminants at elevated levels; however, IDPH cannot reconstruct these exposures.

Elevated levels of cadmium, lead, manganese, and zinc were found in the Red Gate Woods Picnic Area wells, but the source is not known. Because these metals have not been found at elevated levels in the intervening monitoring wells, Plot M is probably not the source of these metals in the Red Gate Woods wells. People may consume this water if CCFPD again makes these wells usable by park visitors. Because exposure to contaminants may have occurred in the past and may occur in the future, IDPH has categorized this site as a "No Apparent Public Health Hazard."

### Recommendations

IDPH recommends that:

- 1. DOE continue to monitor groundwater at Plot M and the Red Gate Woods Picnic Area for contaminants thought to be buried at Plot M.
- 2. DOE monitor and maintain the integrity of the cap of Plot M.
- 3. The Cook County Forest Preserve District (CCFPD) not place the wells at the Red Gate Woods Picnic Area back into service.

Recommendations one and two will be part of the site maintenance by DOE. IDPH will share recommendation three with CCFPD.

### **Public Health Action Plan**

IDPH will inform concerned residents of the public health implications associated with Plot M. IDPH will work with DOE to hold a public availability session once documents for all the various areas are complete.

### **Preparers of Report**

### Preparer

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Tables

Radionuclide	MCL (Bq/L)	Back- ground Shallow (Bq/L)	On-site Shallow (Bq/L)	Off-site Shallow (Bq/L)	On-site Intermediate (Bq/L)	Off-site Intermediate (Bq/L)	On-site Deep (Bq/L)	Off-site Deep (Bq/L)
Tritium (1/24-11/1/90)	741	ND-18.5	170-240,000	2,480-73,400	222-35,400	6,440-6,740	133-25,300	5,810-44,100
Tritium (2/23-12/3/98)	741	ND-48	1,140-115,000	2,110-494,000	66.7-255,000	66.7-255,000 2,930-3,290		189-604
Strontium 90 (2/23-12/3/98)	0.3	ND-0.16	ND-0.25	ND-0.17	0.024-0.16	ND	ND-0.013	0.014-0.017

Table 1. Levels of radionuclides in on-site and off-site shallow intermediate, and deep glacial till boreholes near Plot M (1) (3).

MCL = USEPA maximum contaminant level

Bq/L = Becquerels per liter ND = Not detected

Table 2.Levels of inorganic chemicals in water from the Red Gate Woods replacement<br/>well 5160, February to November 1990 (3) and February to March 1998 (1) in<br/>parts per billion (ppb).

Chemical	Level 2-11/90	Level 2-3/98	Comparison Value	Source of Comparison Value
Cadmium	ND-6.7	1.5-4.5	2	EMEG
Lead	20-110	95-168	15	USEPA Action Level
Manganese	187-1,040	290-486	50	RMEG
Zinc	1,930-24,250	11,600-25,000	3,000	RMEG

ND = Not detected

EMEG = Environmental Media Evaluation Guide.

RMEG = Reference Dose Media Evaluation Guide.

Location	Levels (Bq/L)	MCL for tritium (Bq/L)		
1	ND	741		
2	ND-44.4	741		
3	70.4-2,900	741		
4	59.3-2,600	741		
5	63.0-2,211	741		
6 (seep)	2940-13,600	741		
7	170-1,880	741		
8	100-3,610	741		
9	156-1,890	741		
10	159-1,010	741		
11	88.9-559	741		
Outfall (Illinois and Michigan Canal)	ND	741		

Table 3.Levels of tritium in surface water from the stream near Plot M, January 17 to<br/>November 29, 1990 (3).

ND = Not detected

Bq/L = Becquerels per liter

MCL = USEPA maximum contaminant level

Location	Tritium (Bq/L)	Strontium 90 (Bq/L)	Uranium 234 (Bq/L)	Uranium 238 (Bq/L)	
Upstream (location 1)	ND	0.011-0.19	0.002-0.007	0.002-0.009	
Downstream (location 9)	27.1-478	0.017046	0.002-0.024 0.003-0.02		
MCL (Bq/L)	741	0.3	1	.1	

Table 4.Levels of radionuclides in water from the intermittent stream near Plot M, June 12 to November 10, 1998 (1).

MCL = USEPA maximum contaminant level ND = Not detected Bq/L = Becquerels per liter

Pathway Name	Source	Environmental Transport Medium	Point of Exposure	Route of Exposure	Exposed Population	Exposure Activities	Estimated Number Exposed	Time of Exposure	Chemicals or Radionuclide
Completed Pathways									
Groundwater	Plot M	Groundwater	Red Gate Woods Picnic Area Wells	Ingestion Skin contact	Park visitors, On- site workers	Mountain biking, Cross-country skiing, Hiking, Horseback, and Picnicing (Park visitors); Park maintenance (on- site workers)	1,000	Past	Table 2
Potential Pathways									
Air	Plot M	Air	Plot M (past); Stream by Plot M	Inhalation	Park visitors, On- site workers	Hiking and horseback riding (park visitors), On- site remediation (workers)	150	Past, Present, Future	Tritium; unknown for past before Plot M capped
Biota	Plot M	Surface water, Sediments, and Biota	Illinois and Michigan Canal	Ingestion of fish	Anglers and their families	Fishing and eating fish	100	Past, Present, Future	Unknown possible non-radioactive contaminants
Sediments	Plot M	Sediments	Stream by Plot M	Skin contact, Ingestion	Park visitors, Workers	Playing in stream, Remediation work	100	Past, Present, Future	Unknown non- radioactive contaminants
Soil	Plot M	Soil	Plot M	Skin contact, Ingestion	On-site workers	On-site disposal, On-site remediation	50	Past	Unknown
Surface Water	Plot M	Surface Water	Stream by Plot M	Skin contact	Park visitors, Workers	Playing in stream, Remediation work	100	Past, Present, Future	Tritium

# Table 5. Completed and potential exposure pathways at Plot M.

**Figures and 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 Priorities List (NPL) sites, and potential for human exposure. They are not action levels but are comparison values. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They 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. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They 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.

Maximum Contaminant Levels (MCLs) have been established by USEPA for public water supplies to reduce the chances of occurrence of adverse health effects from use of 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. They represent the concentrations of chemicals in drinking water that are not expected to cause any adverse, non-carcinogenic effects over a lifetime of exposure. These are conservative values that incorporate a margin of safety.

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

Action Levels are established by the U.S. Environmental Protection Agency (USEPA). An action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow. For lead or copper it is the level which, if exceeded in more than 10% of the homes tested, triggers treatment.