Inspection Status Report of Site A/Plot M

Report for 2020

Environment, Safety, Health, and Quality Directorate

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Inspection Status Report of Site A/Plot M

Report for 2020

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September 2020

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2020 SITE INSPECTION REPORT FOR SITE A AND PLOT M

1.0 EXECUTIVE SUMMARY

The Site A/Plot M, Decommissioned Reactor Site was inspected on September 24, 2020. Site A/Plot M is located in the Palos Area Preserves, operated by the Forest Preserve District of Cook County. The site was found to be in good condition with minimal erosional concerns across the grass covered mound at Plot M. Landscaping timbers installed along the footpath north of Plot M is effective in reducing erosion down the hill. Erosion concerns at Plot M are being addressed by Argonne National Laboratory (ANL). The bike trail installed by Cook County Forest Preserve to the east of Plot M has helped reduce traffic at the site. The Plot M monument appears solid with no visible cracks. The Site A monument has several cracks present that will possibly widen over time. No cause for a follow up inspection was identified.

The 17 groundwater monitoring wells at Site A/Plot M were secure and in good condition. ANL prepares an annual report "Surveillance of Site A and Plot M", which contains monitoring results and independent analysis of samples conducted by the Illinois Emergency Management Agency. The results indicate the radioactivity remaining at Site A/Plot M does not pose a risk to the health or safety of the public visiting the site, using the picnic areas, bike trails or living in the vicinity. ANL continues to monitor the sites on a quarterly schedule.

During the May 2018 Annual Inspection, increased erosion was noted along the path from the northeast corner of Plot M heading down towards the creek. Twelve timber steps were installed in 2018 to reduce erosion along the northeast trail. In 2020 four additional timber steps were installed on the steep portion of the northeast trail. Figures 1.1, 1.2 and 1.3 show views of the new timber steps which have significantly reduced erosion

The results of the surveillance program indicate that the radioactivity remaining at Site A/Plot M does not endanger the health or safety of the public visiting the site, using the picnic areas, or living in the vicinity.

Figure 1.1 View of timber steps installed along northeast path at Plot M.

Figure 1.2 Northeast view of timber steps installed along the path at Plot M.

Figure 1.3 North view of timber steps installed along northeast path at Plot M.

2.0 INTRODUCTION

2.1 Annual Inspection Background

This report presents the findings of the 2020 annual inspection of the Site A/Plot M, Illinois, Decommissioned Reactor Site at the Palos Forest Preserve in Cook County, Illinois, and summarizes environmental monitoring results reported by the Argonne National Laboratory (ANL) for 2019. Features and photographed locations discussed in this report are shown in Section 8.0.

Argonne National Laboratory conducted the site inspection on September 24, 2020. DOE-Legacy Management contracts directly with ANL for all environmental sampling, analysis, and reporting. This DOE Office of Legacy Management (LM) site, located in a Cook County forest preserve is open to the public and found to be in good condition.

2.2 Site History

Site A/Plot M was the former site of Argonne National Laboratory and its predecessor, the University of Chicago's Metallurgical Laboratory. The site was part of the World War II Manhattan Engineer District Project and was located in a forested area southwest of Chicago, IL, currently owned by the Forest Preserve District of Cook County, now known as the Palos Area Preserves. Research was conducted at two locations in the Palos Area Preserves. The location of the Palos Area Preserves is shown in Figure 2.1. The locations of Site A and Plot M are shown in Figure 2.2.

Site A, is a 19-acre area that contained experimental laboratories and nuclear reactor facilities; Plot M, is a 150 ft x 140 ft area used for the burial of radioactive waste. Operations at Site A began in 1943 and ceased in 1954. Among the research programs carried out at Site A were reactor physics studies, fission product separations, hydrogen-3 recovery from irradiated lithium, and work related to the metabolism of radionuclides in laboratory animals. Radioactive waste and radioactively-contaminated laboratory articles from these studies were buried at Plot M. At the termination of the programs, the reactor fuel and heavy water, used for neutron moderation and reactor cooling, were removed and shipped to Oak Ridge National Laboratory. The biological shield for the CP-3 reactor located at Site A, together with various pipes, valves, and building debris, was buried in place in 1956. Currently at Site A, the only structures visible

Map data©2017 Google

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Figure 2.2 Site A/Plot M Area Map

Geologically, Plot M is constructed on a moraine upland which is dissected by two valleys, the Des Plaines River valley to the north and the Calumet Sag valley to the south. The upland is characterized by rolling terrain with poorly developed drainage. Streams are intermittent and drain internally or flow to one of the valleys. The area is underlain by glacial drift, dolomite, and other sedimentary rocks. The uppermost bedrock is Silurian dolomite, into which both the picnic wells and some of the monitoring wells are placed. The dolomite bedrock is about 200 feet thick. The overlying glacial drift has a thickness that ranges from 165 feet at Site A to zero at the Des Plaines River and Calumet Sag Canal, and the boreholes terminate in this layer. The depth to bedrock at Plot M is about 130 feet.

Hydrologically, the surface water consists of ponds and intermittent streams. When there is sufficient precipitation, an intermittent stream flows past Plot M, continues near the Red Gate Woods picnic well (#5160 in Figure 2.2), and discharges into the Illinois and Michigan (I&M) Canal. The groundwater in the glacial drift and dolomite forms two distinct flow systems. The flow of groundwater in the drift is controlled principally by topography. The groundwater in the dolomite, which is recharged by groundwater migrating downward through the glacial drift, flows toward two discharge areas, the Des Plaines River to the north and the Calumet Sag Canal to the south. There is no groundwater usage downgradient of Site A/Plot M. The former hand-pumped picnic wells have been disabled by removing the handles. These wells are currently used only for groundwater monitoring.

3.0 INSPECTION RESULTS

ANL conducted the site inspection, in attendance were three employees from ANL and two employees from IEMA.

The inspection was conducted in accordance with the Long-Term Surveillance and Maintenance Plan, Site A and Plot M, Palos Forest Preserve, Cook County, Illinois (LMS/SAM/S01063, January 2015). The purposes of the inspection were to look for evidence that the integrity of the disposal site is not threatened, evaluate the condition of the monuments, determine whether maintenance is needed, and examine the condition of the DOE monitoring wells.

Inspectors met at the Red Gate Woods parking area and reviewed the Plan of the Day and Job Safety Analysis. Conditions were dry but due to overgrowth trip hazards and uneven ground conditions were discussed prior to advancing towards the monitoring wells. Photographs were taken of the monitoring wells and are included in Section 8 of this report.

3.1 Red Gate Woods

The former picnic well (#5160) does not have a handle as shown in (P01). The handle was removed by the Cook County Forest Preserve years ago because of fecal coliform found in the water which originated from a nearby restroom facility, which was removed. ANL uses a portable handle to collect the water sample. It was found that the inner pump control rod was not functioning. This handpump well is Cook County property and will need to be repaired.

The four dolomite wells shown in photo locations P02, P03, P04 and P05 were all locked and in good condition. Dolomite well #11 was found with some spray paint across the well cap. This well can be repainted to remove the graffiti. ANL personnel are keeping the Red Gate Woods monitoring wells secure.

3.2 Plot M

The Plot M monument was unchanged from last year's inspection. Several letters had been chiseled off due to vandalism as reported years ago. All six Plot M corner markers

were located and found to be in good condition. Erosion controls have been effective with the addition of four more landscape timbers installed in 2020 along the north trail. As shown in Figures 1.1, 1.2 and 1.3, timber steps were added to eliminate direct hill erosion. ANL conducts quarterly maintenance reviews of the cap and north trail. No repairs were required on the cap, but it was noted by DOE-LM in 2019 that the installation of additional landscape timbers at the top of the slope would further reduce north trail erosion. DOE-LM has requested that the Plot M monument be replaced and ANL acknowledged a project is underway to replace the Plot M monument. The new monument has been ordered and should be installed at a future date yet to be determined by the contracted monument company.

All groundwater wells at Plot M were locked and found to be in good condition with all well numbers on the outer casing. Photographs P06 through P16 show monitoring wells with locked caps. ANL personnel are keeping the Plot M monitoring wells secure.

3.3 Site A

The Site A monument was unchanged from last year's inspection. Visible small cracks are present and have been noted in the monument over the years. Photographs P17 through P19 show monitoring wells with locked caps. DOE-LM has requested that the Site A monument be replaced. ANL acknowledged a project is underway to replace the Site A monument. The new monument has been ordered and should be installed at a future date yet to be determined by the contracted monument company. ANL personnel are keeping the two Site A monitoring wells secure.

Site A/ Plot M 2020 Annual Inspection

Thursday September 24,
2020
10:30am Start
at Red Gate Woods

Attendance:
ANL-Rob Piorkowski,
Jerry Baudino,
Steve Miller

IEMA- Kristen Brown,
Talon Holmes

SIGN IN SHEET

Name	Company	Phone #
Rob Piorkowski	ANL	708-539-4451 c
Talon Holmes	IEMA	217-720-9650
Kristen Brown	IEMA	217-720-5373
Gerald Baudino	ANL	630-252-7637
Steve Miller	ANL	630-252-6933

Figure 3-1 2020 Site A/Plot M Annual Inspection Sign In Sheet

4.0 MONITORING PROGRAM RESULTS

The monitoring program at Site A/Plot M was conducted in accordance with the “Long-Term Surveillance and Maintenance Plan for Site A and Plot M, Palos Forest Preserve, Cook County, Illinois”, issued in January 2015. DOE-LM conducts stewardship activities at Site A and Plot M to protect human health and the environment, facilitate stakeholder involvement, and to comply with applicable regulations. DOE-LM carries out its stewardship responsibilities through a combination of government ownership, conducting regular inspections, maintaining institutional controls, facilitating public awareness, and monitoring environmental media.

The Site A/Plot M monitoring program follows the guidance for monitoring at DOE facilities. Although Site A/Plot M is not an active DOE facility, the same monitoring principles are applicable. The monitoring program is designed to assess the concentration of hydrogen-3 and strontium-90 in groundwater near these sites, and to monitor hydrogen-3 in two of the former picnic wells in Red Gate Woods and several surface water bodies in the vicinity. This is accomplished by analyzing water samples collected from groundwater wells and surface water. Sampling locations are described in the following sections of this report.

The samples were collected by Argonne QAS Division Environmental Monitoring and Surveillance Group and analyzed by the Argonne QAS Division Analytical Services radiochemistry laboratories using DOE-approved methods. The detection limits for hydrogen-3 in water is 0.1 nCi/L and 0.25 pCi/L for strontium-90 in water. The uncertainties associated with individual concentrations for strontium-90 shown in the tables are the statistical counting errors at the 95% confidence level. Because of the amount of hydrogen-3 data presented in many of the tables, the uncertainty values are not included. In such cases, the following typical uncertainties apply:

Hydrogen-3 Concentration (nCi/L)	Uncertainty (% of Conc.)
0.1-1.0	40-5%
1-10	5-1%
> 10	1%

4.1 Site A/Plot M Surface Water

Surface water samples were attempted to be collected quarterly from four sampling locations along the two streams that flow around Plot M, shown in Figure 4.1. Location 1 is upstream of the Plot M area. Location 6 is immediately north and downstream of Plot M. No water was present in the stream bed during the third quarter of 2019, thus no surface water samples were collected from these locations. During the 2017 DOE-LM site visit, it was decided that because the stream flow is intermittent, Location 6 sample would only be collected when flowing water is present. During the third quarter of 2019 three attempts were made to collect stream samples from Plot M after a precipitation event. Despite the attempts, insufficient flow was present for collecting a sample.

The stream samples were analyzed for hydrogen-3 and the results are shown in Table 4.1. The same concentration pattern in the water flowing around Plot M was observed this year as in the past. Concentrations were below the detection limit upstream of Plot M (Location 1); hydrogen-3 was the highest at Location 7 during the fourth quarter. Historically, the lower concentrations were found downstream of Plot M (Locations 7 & 8). The amount of hydrogen-3 at Location 6 in the April sample was 25.5 nCi/L. The other surface water samples collected during 2019 were comparable to concentrations observed in recent years.

Table 4.1 Hydrogen-3 Content of Stream Next to Plot M, 2019

Location Number ¹	Date Collected (Concentrations in nCi/L)			
	March 14	April 30	Q3	December 12
1	<0.1	< 0.1	DRY	<0.1
6	2.1	25.5	DRY	DRY
7	0.96	4.1	DRY	30.1
8	0.18	0.57	DRY	9.2

¹ See Figure 4.1

Figure 4.1 Stream Sampling Locations near Plot M

One set of samples from five surface water bodies in the vicinity of Site A was collected in June of 2019. They are the pond northwest of Site A; the pond southeast of Site A; Horse Collar Slough; Tomahawk Slough; and Bull Frog Lake. These locations are identified in Figure 2.2. The samples were analyzed for hydrogen-3 and the results are presented in Table 4.2. All of the hydrogen-3 results were below the detection limit of 0.1 nCi/L.

Table 4.2 Hydrogen-3 Content of Site A Area Ponds, 2019

Location	June 19 (Concentrations in nCi/L)
NW Site A	< 0.1 (<0.1)
SE Site A	< 0.1
Bull Frog Lake	< 0.1
Horsecollar Slough	< 0.1
Tomahawk Slough	< 0. 1 (<0.1)

4.2 Plot M Groundwater

In 2019, hydrogen-3 was detected in the groundwater beneath Plot M in eight of 9 monitoring wells located in the glacial drift. Nine monitoring wells screened within the glacial drift are present in and around Plot M (Figure 4.2). Two of these wells (BH09 and BH10) were drilled at a 45° angle to intercept groundwater under the waste. Groundwater samples were collected and water level measurements were recorded quarterly in seven wells. Due to low water volume in BH35 during the third quarter, an insufficient sample volume was obtained for strontium-90 analysis.

All of the water samples were analyzed for hydrogen-3; the results are shown in Table 4.3. Duplicate quality control sample results are shown in parentheses. The hydrogen-3 concentrations varied widely from well to well and in some cases from quarter to quarter. The magnitudes of the hydrogen-3 concentrations are similar to those observed over the past several years. Most of the results indicate that hydrogen-3 concentrations are slowly decreasing in these wells.

Figure 4.2 Map of Plot M Site

Table 4.3 Hydrogen-3 Content of Plot M Monitoring Well Water, 2019

Borehole Number	Well Depth (ft)	Date Collected (Concentrations in nCi/L)			
		March 27	June 19	September 18	December 12
BH02	39.41	5.3	6.3	6.5 (6.6) ¹	6.8
BH03	40.00	84 (74)	4.7	8.1	0.2
BH04	36.05	306	296	296	304 (300)
BH06	40.30	309	5,693	3,077	923
BH09	40.00 ²	875	551	284	290
BH10	40.00 ²	12	13	29	13
BH11-1	39.30	51	53	62	59
BH26	60.65	6.1	3.9	62	3.9
BH35	105.50	748	746	737	753

¹ Duplicate QC sample results are denoted in parentheses.

² Slant hole drilled at 45° to a depth of 40 ft. below the surface.

The highest hydrogen-3 concentrations near Plot M during 2019 were found in BH04, BH06, BH35, and the slant well BH09. Figure 4.3 shows the trend in hydrogen-3 concentrations in BH03 and BH04. Since 1989, there has been a steady decrease in hydrogen-3 concentration in these wells. Figure 4.4 shows the trend of hydrogen-3 concentrations in BH09, a slant well with the well screen located directly under Plot M. This well had very high levels of hydrogen-3 during the 1990s, and have since significantly decreased. Since 1999, the hydrogen-3 concentrations have steadily decreased.

Figure 4.3 Hydrogen-3 in Plot M Wells BH03 and BH04

Figure 4.4 Hydrogen-3 in Plot M Well BH09

As shown in Table 4.3, Well BH06 contained high hydrogen-3 concentrations during all four quarters of 2019, with the second quarter of 2019 being the highest. The trend in hydrogen-3 concentrations in BH06 since 1989 is shown in Figure 4.5, which also depicts groundwater elevations in this well. From 1994 through the first half of 2009, the hydrogen-3 concentrations ranged from 50 to 150 nCi/L. Beginning in 2009, hydrogen-3 concentrations increased, reaching values as high as 1,534 nCi/L in 2011, 488 nCi/L in 2012, 748 nCi/L in 2013, 3,035 nCi/L in 2014, 1,223 nCi/L in 2015, 1,360 nCi/L in 2016 and 1,040 nCi/L in 2017, 1,325 nCi/L in 2018 and 5,693 nCi/L in 2019. During this time period, groundwater elevations were found to have fluctuated more than during the period between 1994 and 2009. The changing groundwater elevations could be responsible for the recent increase in hydrogen-3 concentrations and the wide variability between sample results.

Monitoring well BH35 hydrogen-3 concentrations, shown in Figure 4.6, have been steadily increasing since 2003. The cause of the increase is related to downward movement of the hydrogen-3 plume beneath Plot M to the northeast towards the Des Plaines River. Monitoring well BH35 is the deepest at 105 feet below ground surface and downgradient of Plot M.

Figure 4.7 shows hydrogen-3 concentrations in Well BH02 since 1990. The hydrogen-3 concentrations in this well remained at low levels during 2019, as compared to 2012 and 2013, which had several samples with relatively high levels of hydrogen-3. This figure also shows the groundwater elevation in the well. Figure 4.7 indicates that the spikes in hydrogen-3 concentration that occurred in previous years happened during periods when the groundwater elevation was lower than normal. Lower groundwater elevations could change the way groundwater moves and interacts with contaminated soil under Plot M, causing the hydrogen-3 concentrations to vary widely.

Figure 4.5 Hydrogen-3 and Groundwater Elevation in Well BH06

Figure 4.6 Hydrogen-3 in Well BH35

Figure 4.7 Hydrogen-3 and Groundwater Elevation in Well BH02

Groundwater samples from the Plot M monitoring wells were analyzed once for strontium-90 during 2019. The results are shown in Table 4.4. Strontium-90 concentrations greater than the detection limit of 0.25 pCi/L were found in three of the nine sampled wells. The highest strontium-90 concentration in 2019 was 6.2 pCi/L in water collected from BH09, the slant well screened under the Plot M cap. The concentrations found in 2019 were similar to previous results for this well. Strontium-90 concentrations in well BH06 were also elevated. The concentrations of strontium-90 in this well have been slowly increasing since 2010. All results were less than the State of Illinois Class 1 Ground Water Quality Standard of 8 pCi/L for strontium-90.

Table 4.4 Strontium-90 Content of Monitoring Well Water Samples Near Plot M, 2019

Well Number ¹	Well Depth (ft.)	June 19 (Concentrations in pCi/L)
BH02	39.41	<0.25
BH03	40.00	<0.25
BH04	36.05	<0.25 ³
BH06	40.30	2.59 ± 0.210
BH09	40.00 ²	6.21 ± 0.490
BH10	40.00 ²	<0.25 ⁴
BH11-1	39.30	1.21 ± 0.101
BH26	60.65	<0.25
BH35	105.50	NA ⁵

¹ See Figure 4.2

² BH09 and BH10 are slant wells.

³ BH04 was analyzed each quarter for Sr-90 and Cs-137 as part of the intercomparison program with the IEMA laboratory. All Sr-90 samples collected during 2019 from BH04 were <0.25 pCi/L.

⁴ BH10 was analyzed each quarter for Sr-90 and Cs-137 as part of the intercomparison program with the IEMA laboratory. Three Sr-90 samples collected during 2019 from BH10 were <0.25 pCi/L, one result was reported at 0.26 pCi/L.

⁵ No sample due to low water volume at time of collection.

4.3 Site A Groundwater

The locations of the two Site A monitoring wells are shown in Figure 4.8. Hydrogen-3 monitoring results are shown in Table 4.5. The results of duplicate QC samples are shown in parentheses. The results found in the groundwater from wells BH55 and BH56 are most likely originating in the buried CP-3 biological shield. The hydrogen-3 concentrations at Site A are several orders of magnitude lower than at Plot M, and are decreasing. Figure 4.9 shows the decreasing hydrogen-3 concentrations in these two wells. The concentrations of strontium-90 in the Site A monitoring wells were less than the State of Illinois Class 1 Ground Water Quality Standard of 8 pCi/L for strontium-90. The results of the strontium-90 analyses are shown in Table 4.6.

Table 4.5 Hydrogen-3 Content of Monitoring Well Water Samples Near Site A, 2019

Well Number	Depth (ft.)	June 19 (Concentrations in nCi/L)
BH55	87.20	0.71
BH56	102.40	1.71

Table 4.6 Strontium-90 Content of Monitoring Well Water Samples Near Site A, 2019

Borehole Number	Depth (ft.)	June 19 (Concentrations in pCi/L)
BH55	87.20	0.68 ± 0.069
BH56	102.40	0.93 ± 0.085

Figure 4.8 Monitoring Wells at Site A

Figure 4.9 Hydrogen-3 in Site A Wells BH55 and BH56

4.4 Dolomite Well Water

Six wells cased into the dolomite bedrock were sampled once in 2019 to monitor the movement of hydrogen-3 within this aquifer, located downgradient of Plot M. One of the dolomite wells is located near Plot M, and five are located north of Plot M in the Red Gate Woods area, as shown in Figure 4.10. All samples were analyzed for hydrogen-3. The results are shown in Table 4.7. All of the dolomite wells exhibited low but measurable hydrogen-3 concentrations, and all results are consistent with concentrations measured in the past. The well with the consistently highest concentration of hydrogen-3 is DH15. Figure 4.11 shows the hydrogen-3 concentrations in DH15 since 1990. The hydrogen-3 results have been relatively stable in DH15 since 1997. All of the dolomite well samples were below the State of Illinois Class 1 Groundwater Quality Standard of 20 nCi/L. The presence of hydrogen-3 in these wells is explained by the 1988 USGS investigation⁴¹, which indicated a hydrogen-3 plume underlies the stream which flows from Plot M and passes to the northeast of these wells. The plume has spread downward and downgradient, resulting in small amounts of hydrogen-3 in the dolomite in this area.

Other dolomite wells, DH03 and DH04, are located close to and downgradient of Plot M. The 2019 hydrogen-3 result for DH03 was 1.31 nCi/L, which is comparable with surrounding well results from previous years. The hydrogen-3 concentration in remaining dolomite wells were below 2.5 nCi/L. Previous analyses of soil core samples indicated the presence of hydrogen-3 as deep as the drift-dolomite interface in the vicinity of these wells.

Figure 4.10 Locations of Dolomite Wells North of Plot M

Table 4.7 Hydrogen-3 Content of Dolomite Well Water, 2019

Dolomite Well Number	June 19 (Concentrations in nCi/L)
DH03	0.96 (1.31)
DH04	1.18
DH11	0.54
DH12	0.48
DH14	0.48
DH15	2.31

Figure 4.11 Hydrogen-3 Concentrations in Dolomite Well DH15

4.5 Former Picnic Wells

Sampling was conducted once during 2019 at two disabled forest preserve picnic wells (#5160 and #5159) located north of Plot M, as shown in Figure 2.2. The Red Gate Woods North Well (#5160) was disabled in 1999, due to high fecal coliform bacteria levels, by removing the pump handle. The well opposite Red Gate Woods (#5159) is in an undeveloped area of the park and is unusable as a water source since the pump handle has also been removed. The samples were analyzed for hydrogen-3, with the results listed in Table 4.8. The maximum and average hydrogen-3 concentrations since 1996 for wells #5160 and #5159 are presented in Table 4.9. The change in hydrogen-3 concentrations in these wells since 1992 is shown in Figure 4.12.

The 2019 hydrogen-3 concentration in well #5160 was similar to the concentrations observed since 2012. For unknown reasons, the hydrogen-3 levels in this well increased between 2010 and 2012, after experiencing a significant decrease in 2008. The 2019 sample collected from well #5159 contained a concentration of hydrogen-3 similar to previous years. The concentrations of hydrogen-3 in these picnic wells are below the State of Illinois Primary Drinking Water Standard of 20 nCi/L.

Table 4.8 Hydrogen-3 Content of Former Picnic Wells Near Site A/Plot M, 2019

Date Collected	June 19 (Concentrations in nCi/L)
Opposite Red Gate 5159	0.20
Red Gate North 5160	0.80

Table 4.9 Hydrogen-3 Concentrations in the Red Gate Woods Wells

Year	Red Gate Woods North (#5160)		Opposite Red Gate Woods (#5159)	
	Maximum (nCi/L)	Annual Average (nCi/L)	Maximum (nCi/L)	Annual Average (nCi/L)
1996	2.19	1.56	0.55	0.33
1997	1.26	1.00	1.13	0.35
1998	1.23	1.03	0.72	0.47
1999	1.22	1.07	2.14	0.45
2000	1.54	1.33	2.20	0.70
2001	1.59	1.49	0.27	0.16
2002	1.47	1.04	3.17	0.45
2003	1.78	1.06	1.49	0.43
2004	1.08	1.00	0.34	0.17
2005	1.01	0.95	0.34	0.19
2006	1.14	1.06	2.63	1.11
2007	1.45	1.28	0.66	0.33
2008	1.24	0.33	0.32	0.26
2009	0.13	0.10	0.50	0.33
2010	0.28	0.19	0.51	0.34
2011	0.91	0.67	3.60	1.10
2012	2.10	1.60	0.74	0.34
2013	2.24	2.14	0.75	0.35
2014	2.02	1.96	0.55	0.37
2015	1.92	- ^a	0.51	-
2016	1.71	-	1.16	-
2017	1.28	-	0.70	-
2018	1.33	-	0.48	-
2019	0.80	-	0.20	-

^a An annual sampling frequency began in 2015.

Figure 4.12 Hydrogen-3 in Former Picnic Wells from 1992 Through 2019

5.0 RISK ASSESSMENT

ANL has addressed the exposure pathways and potential radiation dose estimates in “Surveillance of Site A and Plot M, Report for 2019”. The results indicate that the site does not pose a risk to human health or the environment. There is no human consumption of water from surface water or wells and the radioactive material present in this area does not represent a health risk to the public.

6.0 IEMA INDEPENDENT ANALYSIS OF ANL WATER SAMPLES

In 2019, the Illinois Emergency Management Agency (IEMA) performed an independent analysis of water samples collected at the Palos Forest Preserve.

Commencing in 2012, Argonne has participated in a program of dividing a subset of the Site A/Plot M water samples collected and submitting one half of each sample to IEMA for analysis. The IEMA operates a laboratory which conducts radiological analyses using methods similar to Argonne.

A duplicate set of two samples during the first, third and fourth quarter and six samples during the second quarter is analyzed by both Argonne and the IEMA for hydrogen-3, strontium-90, and cesium-137. The results are compared to identify any discrepancies that may be occurring within the processes being conducted by the two analytical laboratories that would affect the results.

Results can be found in “Surveillance of Site A and Plot M, Report for 2019”, which will be made available to the public on the DOE-LM website once it is finalized.

7.0 ACTIONS

1. Red Gate Woods North Well is not functional with manual pump handle.

Action: ANL will work with Cook County Forest Preserve to repair North Well to enable sample collection but maintain the well as a sample location and not a source of drinking water.

2. One well (#DH11) at Red Gate Woods was identified having graffiti.

Action: ANL will repaint the well and during quarterly site visits conduct site inspections of the monitoring wells and monuments.

8.0 PHOTOGRAPHS

Photograph Number	Photograph Location Description
P01	Former Picnic Well (#5160) North Well at Red Gate Woods
P02	Dolomite Well (#DH11) at Red Gate Woods
P03	Dolomite Well (#DH12) at Red Gate Woods
P04	Dolomite Well (#DH14) at Red Gate Woods
P05	Dolomite Well (#DH15) at Red Gate Woods
P06	Dolomite Well (#DH03) at Plot M
P07	Monitoring Well (#BH04 and #BH35) at Plot M
P08	Monitoring Well (#BH04) at Plot M
P09	Monitoring Well (#BH35) at Plot M
P10	Monitoring Well (#BH09) at Plot M
P11	Monitoring Well (#BH10) at Plot M
P12	Monitoring Well (#BH11) at Plot M
P13	Monitoring Well #BH11 located in between timber steps on the northeast trail at Plot M, four new timber steps are shown at the top of the hill.
P14	Monitoring Well #BH11 and #BH03 located on the northeast trail at Plot M
P15	Monitoring Well (#BH26) at Plot M.
P16	Monitoring Well (#BH02) at Plot M.
P17	Information sign located at Site A with Monitoring Well (#BH55) in the foreground
P18	Monitoring Well (#BH55) at Site A
P19	Monitoring Well (#BH56) at Site A
P20	Southeast pond at Site A.
P21	Monument at Plot M.
P22	Monument at Site A.
P23	Monument at Site A, Site Information Marker and BH#55.
P24	Information marker signs at the entrance to Site A.

P01- Former Picnic Well (#5160) North Well at Red Gate Woods

P02- Dolomite Well (#DH11) at Red Gate Woods

P03- Dolomite Well (#DH12) at Red Gate Woods

P04- Dolomite Well (#DH14) at Red Gate Woods

P05- Dolomite Well (#DH15) at Red Gate Woods

P06- Dolomite Well (#DH03) at Plot M

P07- Monitoring Well (#BH04 and #BH35) at Plot M

P08- Monitoring Well (#BH04) at Plot M

P09- Monitoring Well (#BH35) at Plot M

P10- Monitoring Well (#BH09) at Plot M

P11- Monitoring Well (#BH10) at Plot M

P12- Monitoring Well (#BH11) at Plot M

P13- Monitoring Well #BH11 located in between timber steps on the northeast trail at Plot M, four new timber steps are shown at the top of the hill.

P14- Monitoring Well #BH11and #BH03 located on the northeast trail at Plot M

P15- Monitoring Well (#BH26) at Plot M.

P16- Monitoring Well (#BH02) at Plot M.

P17- Information sign located at Site A with Monitoring Well (#BH55) in the background.

P18-Monitoring Well (#BH55) at Site A

P19-Monitoring Well (#BH56) at Site A

P20-Southeast Pond at Site A.

P21-Monument at Plot M.

P22-Monument at Site A.

P23-Monument at Site A, Site Information Marker and BH#55.

P24-Information Marker signs at the entrance to Site A.

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