

2016 Inspection and Annual Site Status Report for the Site A/Plot M, Illinois, Decommissioned Reactor Site

July 2016



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

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Appendix

Appendix A Site Drawing

Abbreviations

ANL	Argonne National Laboratory
DOE	U.S. Department of Energy
GEMS	Geospatial Environmental Mapping System
IEMA	Illinois Emergency Management Agency
LM	Office of Legacy Management
LTSP	Long-Term Surveillance Plan
pCi/L	picocuries per liter
PLs	photograph locations

Summary

The Site A/Plot M, Illinois, Decommissioned Reactor Site was inspected on May 17, 2016. The site, located within Cook County forest preserve that is open to the public, was found to be in good condition with one exception. Erosion on top of the grass-covered mound at Plot M continues to be a concern as presented in previous inspections. Ruts form in the soil on top of Plot M as a result of bike traffic using the open field as a pass thru between established bike trails within the forest preserve. Argonne National Laboratory (ANL) who is contracted directly from U.S. Department of Energy (DOE) has filled in the ruts with top soil and reseeding remains an ongoing process. Reseeded areas from 2015 are progressing nicely. No cause for a follow-up inspection was identified.

In 2015, ANL plugged and abandoned 8 of 25 monitoring wells (BH41, BH51, BH52, BH54, DH9, DH10, DH13, and DH17). The 17 groundwater monitoring wells remaining at the site were inspected to confirm that they were locked and in good condition.

Preliminary environmental monitoring results for 2015 are provided in a draft report titled *Surveillance of Site A and Plot M, Report for 2015*, prepared by ANL. The report also contains results of an independent analysis conducted by the Illinois Emergency Management Agency on some of the samples collected by ANL in 2015. The draft report states that the results of the surveillance program continue to indicate that the impact of radioactivity at Site A/Plot M is very low and does not endanger the health of those living in the area or visiting the site. The ANL monitoring report will be made available to the public on the DOE Office of Legacy Management public website when it is issued as final.

A new county forest preserve campsite opened in 2015 at Bull Frog Lake, which is east of Plot M. Hiking trails connect Bull Frog Lake with Site A/Plot M. The site might receive more traffic from forest preserve visitors now that this new campsite is opened.

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1.0 Introduction

This report presents the findings of the 2016 annual inspection of the Site A/Plot M, Illinois, Decommissioned Reactor Site at the Palos Forest Preserve in Cook County, Illinois. This report also summarizes preliminary environmental monitoring results reported by ANL for 2015. Features and photograph locations (PLs) discussed in this report are shown in Appendix A.

The following points describe the site:

1. Site A is approximately 19 acres in size. It contains two buried nuclear reactor shells and buried debris from the various support buildings associated with the reactors and other laboratory operations. Operations commenced in 1943 and decommissioning was complete by 1956. The only structures visible are the stone monument marking the site, occasional concrete flatwork and fence post collars, a section of the original chain link fence, and monitoring wells. The site surface, which had been cleared and used as a golf course before World War II, is returning to hardwood forest. Groundwater in the glacial drift beneath Site A was monitored one time in 2015 for tritium (also called hydrogen-3) at monitoring wells BH55 and BH56.
2. Plot M is less than 1 acre in size and contains a series of trenches that were used to bury radioactive wastes. A granite monument and six corner markers are on the site, which consists of a mounded earth cover, planted in grass, over an inverted concrete box. The concrete box was constructed in 1956. It is intended to reduce infiltration and lateral movement of soluble contaminants. Groundwater in the glacial drift beneath Plot M was monitored quarterly in 2015 for tritium and one time for strontium-90 at nine monitoring wells (BH2, BH3, BH4, BH6, BH9, BH10, BH11, BH26, and BH35). Groundwater in the dolomite bedrock wells north of Plot M was monitored in 2015 for tritium at six monitoring wells (DH3, DH4, DH11, DH12, DH14, and DH15). Tritium contamination in groundwater beneath Plot M is thought to result from a single period of release before the concrete containment box was installed.
3. Office of Legacy Management (LM) contracts directly with ANL for all environmental sampling, analysis, and reporting. Environmental monitoring reports are issued annually by ANL.
4. In 2003 and 2004, staff from the LM office in Grand Junction, Colorado, worked with representatives of the DOE Chicago Operations Office, ANL, and Illinois Emergency Management Agency (IEMA) to evaluate groundwater and surface water conditions and the current monitoring program. The evaluation demonstrated that contaminant levels were diminishing and the lateral and vertical extent of contamination had not increased. The monitoring program was revised, as described in the *Environmental Monitoring Program at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois* (GJO-2004-558-TAC, February 2004).
5. In 2005, LM incorporated monitoring data from the ANL database into LM's GEMS (Geospatial Environmental Mapping System) database. The GEMS database monitoring data for the site can be accessed at the LM public website at <http://www.lm.doe.gov/land/sites/il/sitea/sitea.htm>.

6. In 2011, LM performed a five-year review of groundwater monitoring results. The report concluded that:
 - Quarterly monitoring for tritium should continue at all nine glacial drift monitoring wells and at all surface water locations at Plot M.
 - The Long-Term Surveillance Plan (LTSP) objective could be met with all other monitoring being performed on an annual schedule.
7. In 2014, a supplemental assessment was made of the groundwater and surface water monitoring activities at Site A/Plot M. The supplemental assessment identified eight groundwater monitoring wells that could be plugged and abandoned without jeopardizing LTSP objectives.

In 2015, the monitoring schedule proposed in the 2011 groundwater review was implemented, and the eight groundwater monitoring wells identified in the 2014 supplemental assessment (BH41, BH51, BH52, BH54, DH9, DH10, DH13, and DH17) were plugged and abandoned.

2.0 Inspection Results

The May 17, 2016, inspection was conducted by LM contractor personnel M. Miller and K. Broberg. Inspection participants included:

- G. Hooten, LM
- B. Quirk, DOE Chicago Operations Office
- G. Baudino, ANL
- L. Moos, ANL
- T. Holmes, IEMA
- B. Russell, IEMA

D. Robbins (IEMA) joined the inspection team approximately halfway through the inspection.

It should be noted that IEMA does not have regulatory authority over DOE at Site A/Plot M, but IEMA personnel are informed of and consulted with on long-term surveillance and maintenance activities that DOE conducts at the Site A/Plot M site.

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, to evaluate the condition of the monuments, to determine whether maintenance is needed, and to examine the condition of DOE monitoring wells.

Inspectors met at the Red Gate Woods parking area and reviewed the Plan of the Day and the Job Safety Analysis. Inspectors noted that the pump handles remained off the picnic wells and that a portable restroom was no longer present in the area (PL-1). The handles were removed from the pumps years ago to prevent use of the well due to fecal coliform in the water. The fecal coliform originated from a nearby permanent restroom facility, which was removed.

2.1 Site A

Inspectors were able to drive to Site A during this year's inspection. Site A and the Site A monument were in good condition. The crack in the Site A monument appears to be getting larger over time (PL-2). In 5–10 years the monument might need to be replaced, but for now the monument remains serviceable.

Two monitoring wells remain at Site A: BH55 and BH56. Both monitoring wells were secured with locks and identified with a well number on the outer casing (PL-3, PL-4). ANL personnel visited the wells one time in 2015 for sampling, to ensure well security, and to perform any required maintenance.

A brick was present on the ground surface of Site A, approximately 30 yards from the monument on a compass bearing of 136 degrees (PL-5). DOE requested that ANL personnel return to the site, scan the brick for potential radiation, and use the scan results to dispose of the brick appropriately.

Vegetation growth along the lower portion of the access road to Site A (near the Archer Avenue turnoff) is an ongoing issue. ANL is doing a good job of working with the Palos Forest Preserve District to maintain control of the encroaching vegetation. It is recommended that ANL continue to work with the forest preserve district to keep the road clear of encroaching vegetation.

2.2 Plot M

The Plot M site marker was unchanged from last year's inspection. It was in good condition, with the exception of some minor vandalism that occurred several years ago (i.e., some words on the marker are chiseled off) (PL-6). All Plot M corner markers were located and found to be in good condition. ANL is planning to clear vegetation from the west, northwest, and northeast sides of the Plot M mound to make the corner markers more visible, and to keep vegetation off the footprint of the buried inverted concrete box.

Erosion on top of the grass covered mound at Plot-M continues to be an issue. The erosion is caused by visitors riding their bicycles across the mound. ANL conducts annual maintenance reviews of the grass-covered mound and periodically adds topsoil to erosion ruts as needed to keep them from expanding. Rut repairs made in 2015 are progressing nicely in that the areas are becoming reestablished with new grass growth (PL-7 and PL-8). Additional repairs were not needed at the time of the inspection.

It was noted during the inspection that the forest preserve had conducted controlled burns on other portions of the preserve. ANL will inform the forest preserve district that DOE is open to the idea of letting the forest preserve district conduct a controlled burn on the grass-covered mound at Plot M to help reduce the establishment of woody vegetation.

All groundwater monitoring wells at Plot M and north of Plot M were found to be secured with locks and identified with a well number on the outer casing. ANL personnel are doing a good job keeping the wells secure.

3.0 Monitoring Results

ANL collects water samples in accordance with the *Environmental Monitoring Program at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois*. All samples are analyzed for tritium. Samples from monitoring locations near historic occurrences of strontium-90 are analyzed for that radionuclide. Preliminary monitoring results for 2015 are compiled in the *Surveillance of Site A and Plot M, Report for 2015*, which will be available to the public on the LM public website once it has been issued as final. Preliminary monitoring results for 2015 are summarized below.

Beginning in 2016, DOE has requested that ANL also provide field notes from each sampling event to DOE for review.

3.1 Surface Water

Surface water is sampled quarterly at four locations near Plot M: locations 0001, 0006, 0007, and 0008. All four locations were dry in the third quarter of 2015, so only three quarterly sampling events were conducted in 2015.

As shown in Detail A on the attached map, three of the sampling locations (0001, 0006, and 0007) sample an intermittent stream that runs along the east side of Plot M and a seep into that stream. Location 0008 monitors a separate intermittent stream that flows from the northwest corner of plot M. The two streams join north of Plot M.

For the intermittent stream that runs along the east side of Plot M, sample location 0001 is upgradient of Plot M and sample locations 0006 and 0007 are downgradient of Plot M. In 2015, tritium levels exceeded the State of Illinois standard of 20,000 picocuries per liter (pCi/L) at both downgradient locations (seep location 0006 and surface sampling location 0007).

Tritium levels at seep location 0006 ranged from 12,000 to 154,000 pCi/L (Figure 1) in 2015. The 154,000 pCi/L level is the second highest level observed at seep location 0006 since 1999. In 2014 the measured concentration was higher (248,000 pCi/L). The unusually high concentrations in 2014 and again in 2015 could be due to altering the sampling point in 2014. Prior to 2014, the sample was collected from a natural shallow depression in the intermittent stream bed. Since 2014 the samples have been collected from a shallow hole dug into the stream bank. The shallow hole, compared to the natural shallow impression, provides a sample that contains a higher fraction of seepage water and less rainwater runoff. It is also possible that the course of this intermittent stream could be changing a little. ANL plans to walk down this stream in 2016 to determine whether the course appears to be shifting and if any additional seeps can be located for sampling. Tritium activities at location 0007 ranged from 910 to 59,000 pCi/L in 2015. At surface sampling location 0007 the east side intermittent stream crosses over a hiking trail (PL-8). ANL is working with the forest preserve district to determine the best way to route water from the stream so that it runs beneath the hiking trail.

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Plot M, Surface Water**

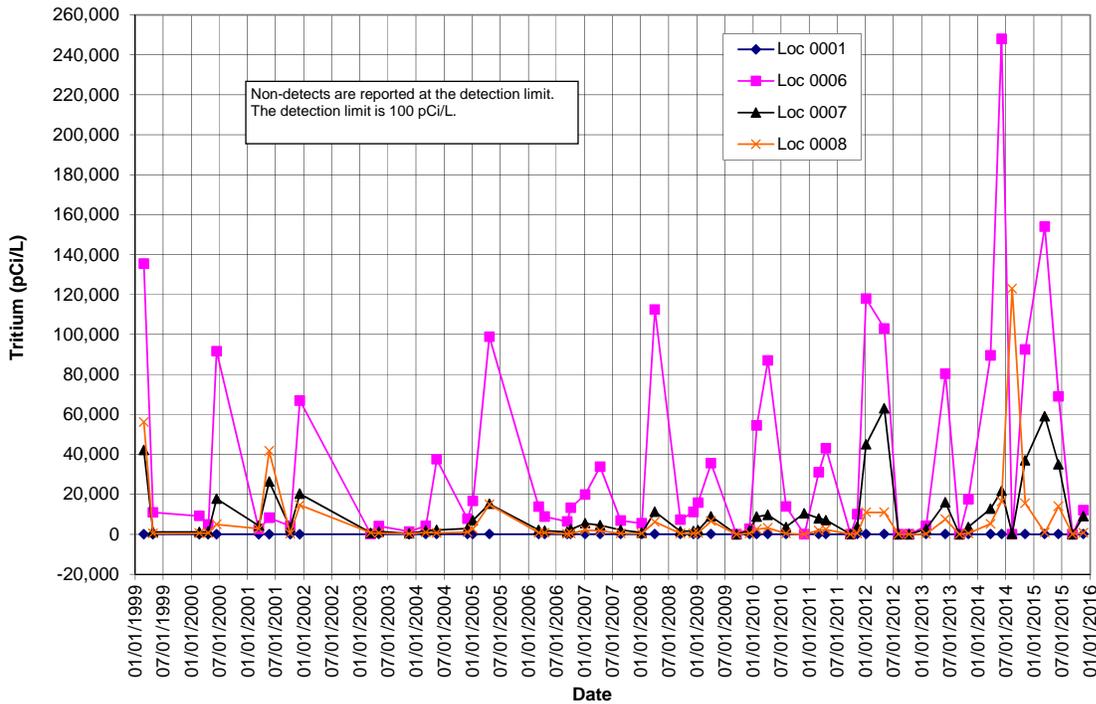


Figure 1. Tritium Activities in Surface Water at Plot M, Cook County, Illinois

Tritium activities at surface water location 0008 ranged from 730 pCi/L to 14,000 pCi/L in 2015.

Quarterly surface water samples collected from five area ponds in 2015 (NW Site A, SE Site A, Bull Frog Lake, Horse Collar Slough, and Tomahawk Slough) were all less than the tritium detection limit of 100 pCi/L.

3.2 Groundwater—Glacial Drift

In 2015, tritium was detected in the groundwater at Site A in two monitoring well locations completed in the glacial drift. No measured activities exceeded the standard of 20,000 pCi/L. Activities ranged from 1150 to 1310 pCi/L (Figure 2).

In 2015, strontium-90 was detected in the groundwater at Site A in two monitoring well locations completed in the glacial drift. Activities ranged from 0.85 to 1.59 pCi/L, but none exceeded the State of Illinois standard of 8 pCi/L (Figure 3).

In 2015, tritium was detected in the groundwater beneath Plot M at all nine of the monitoring wells completed in the glacial drift. Tritium concentrations ranged from 11,100 pCi/L to 1,223,000 pCi/L (Figure 4).

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Site A, Glacial Drift**

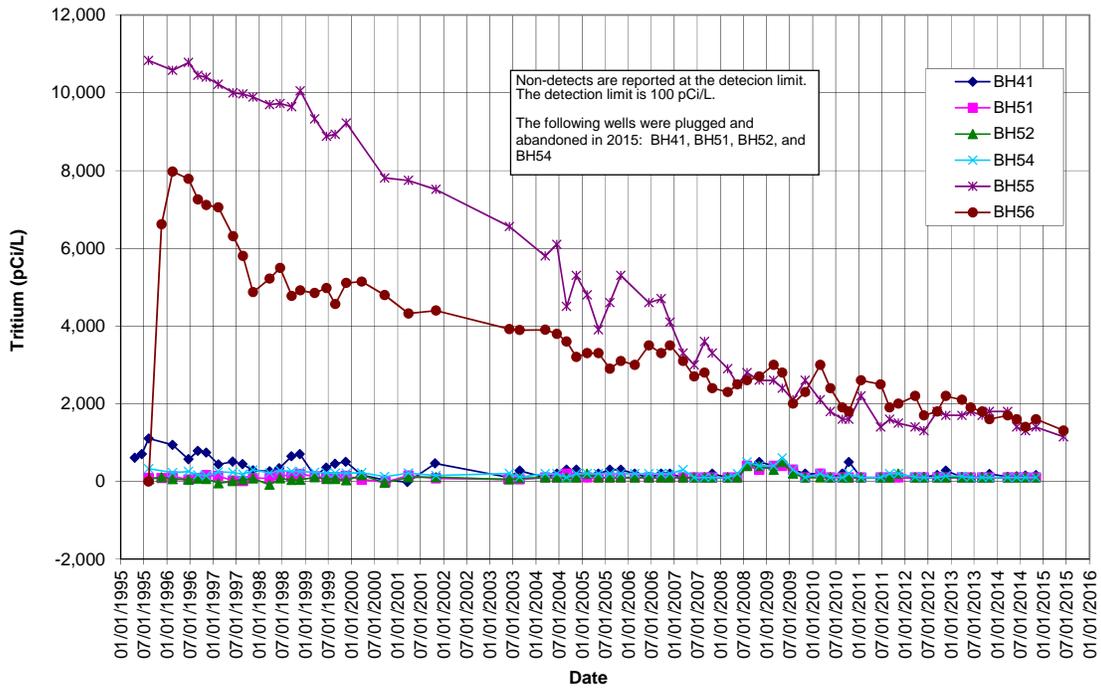


Figure 2. Tritium Activities in Groundwater in the Glacial Drift at Site A, Cook County, Illinois

**Site A/Plot M Decommissioned Reactor (SAM01)
Strontium-90 Concentration, Site A, Glacial Drift**

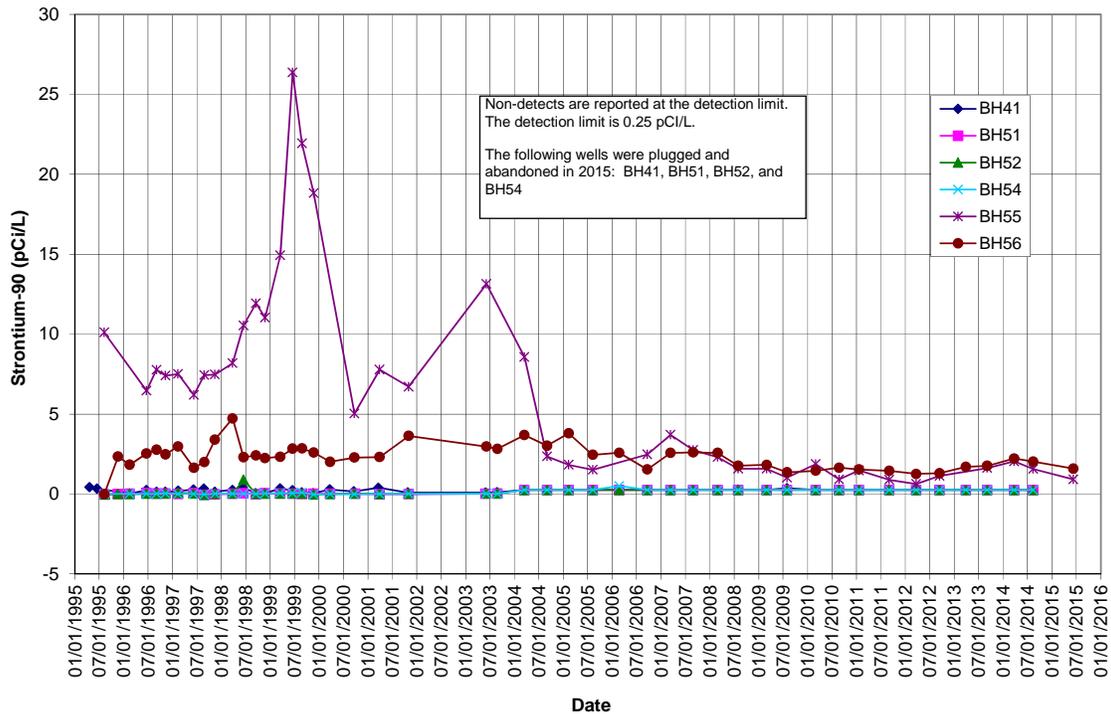


Figure 3. Strontium-90 Activities in Groundwater in the Glacial Drift at Site A, Cook County, Illinois

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Plot M, Glacial Drift**

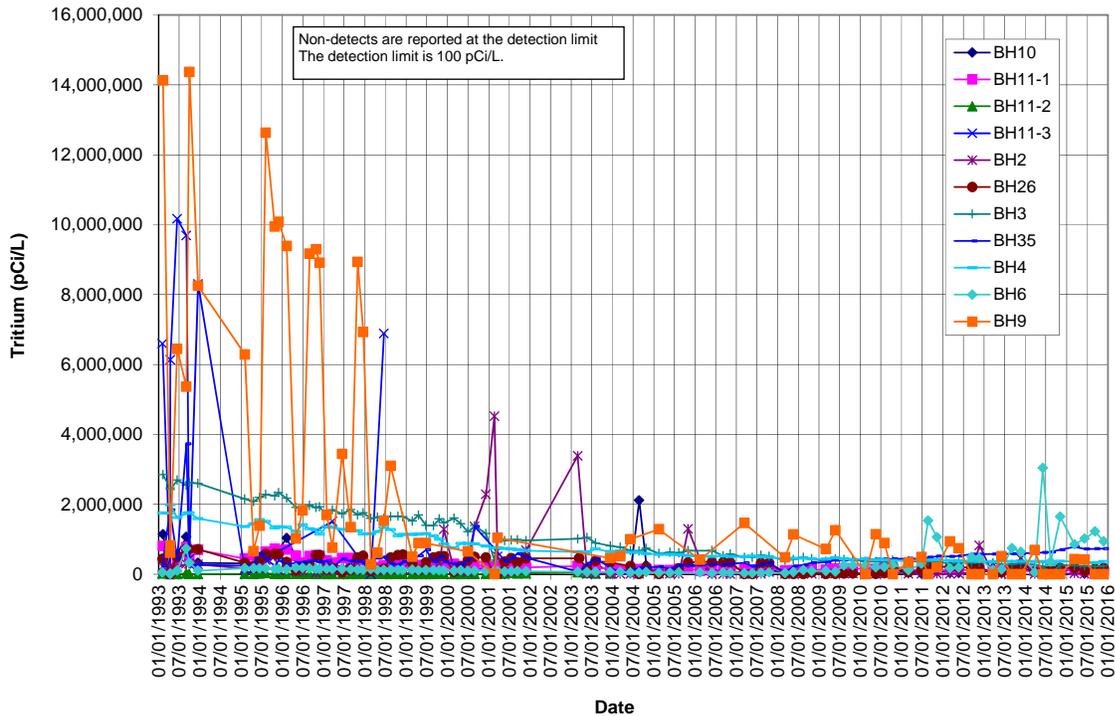


Figure 4. Tritium Activities in Groundwater in the Glacial Drift at Plot M, Cook County, Illinois

During the inspection, ANL personnel reported that monitoring well BH35 has a damaged casing (PL-10). Samples are being collected from a 1-inch sleeve that is installed inside the damaged casing. DOE requested that ANL plan on installing a replacement well for BH35 in the next year or so.

As reported in the draft version of the *Surveillance of Site A and Plot M, Report for 2015*, tritium concentrations and water levels in monitoring well BH6 began to fluctuate erratically in 2009. DOE has requested that ANL look into using non-invasive investigative techniques to determine a possible cause for the changing conditions (e.g., ground-penetrating radar survey of the concrete cap, and/or tracer tests of water flow).

In 2015, strontium-90 was detected in the groundwater at Plot M at three of the nine groundwater monitoring wells. Activities ranged from non-detect (less than 0.25 pCi/L) to 4.77 pCi/L, but none exceeded the State of Illinois standard of 8 pCi/L.

3.3 Groundwater—Dolomite Bedrock

In 2015, tritium was detected in the groundwater at the picnic wells at the Red Gate Woods picnic area. Activities for the two picnic wells in 2015 ranged from 510 pCi/L to 1920 pCi/L (Figure 5). No activities measured in 2015 exceeded the State of Illinois standard of 20,000 pCi/L.

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Picnic Wells, Dolomite Bedrock**

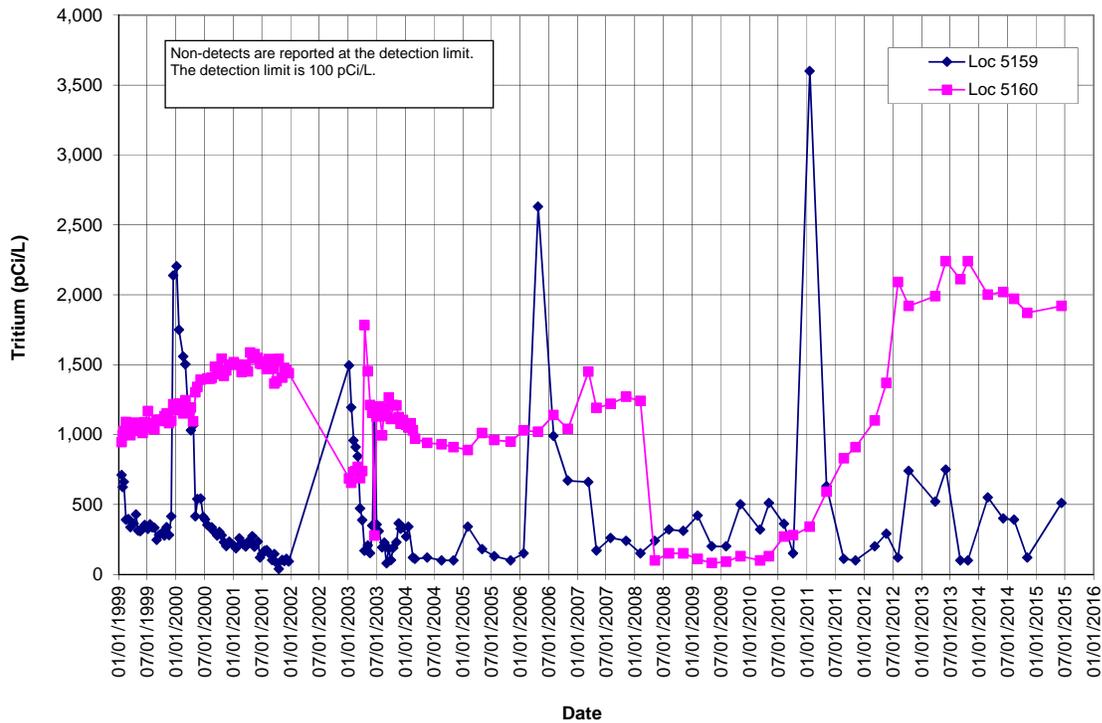


Figure 5. Tritium Activities in Groundwater in the Picnic Wells, Site A/Plot M, Cook County, Illinois

In 2015, tritium was detected in the groundwater at all six monitoring wells completed in the dolomite bedrock north of Plot M. Activities ranged from 510 pCi/L to 2450 pCi/L (Figure 6). Tritium is no longer sampled for in the dolomite bedrock beneath Site A. Monitoring stopped in 2004 after approximately 30 years of sampling failed to detect tritium.

**Site A/Plot M Decommissioned Reactor (SAM01)
Tritium Concentration, Plot M, Dolomite Bedrock**

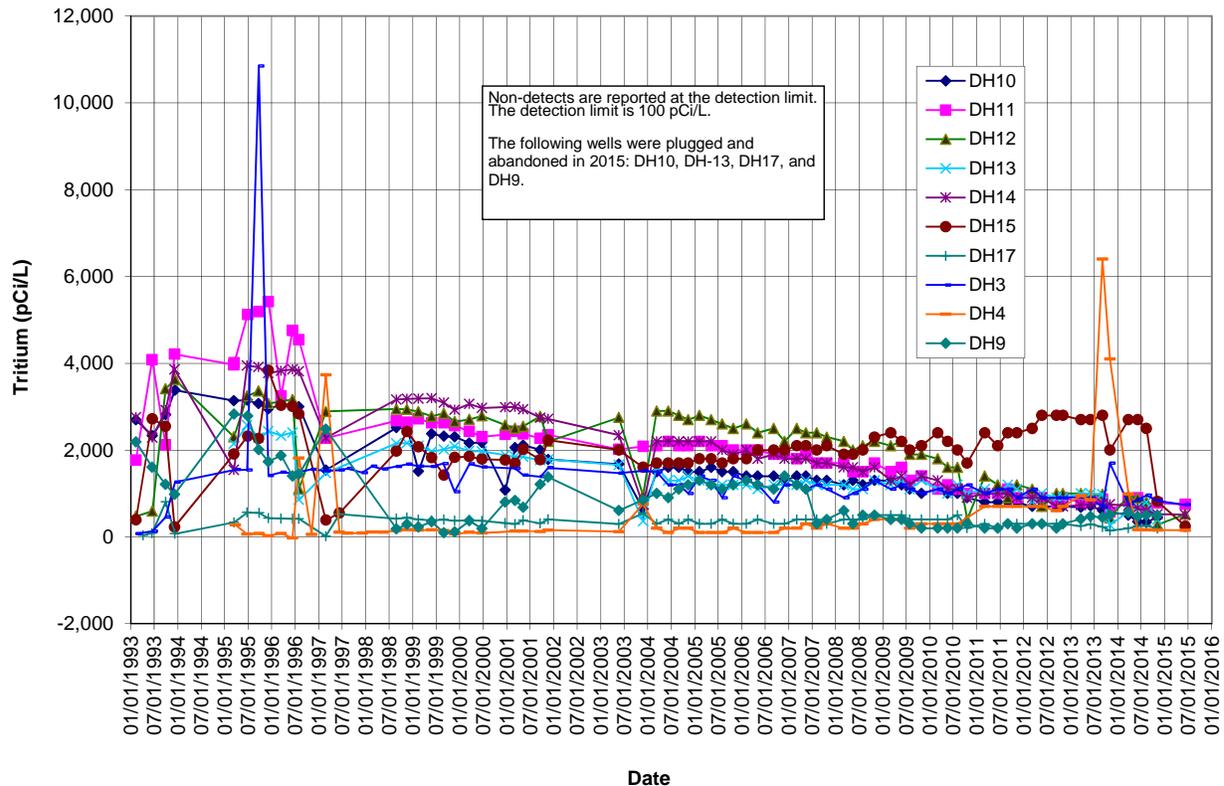


Figure 6. Tritium Activities in Groundwater in the Dolomite Bedrock, Site A/Plot M, Cook County, Illinois

3.4 Risk Assessment

As reported by ANL, all exposure pathways to contaminated groundwater are incomplete (handles have been removed from the picnic wells because of fecal coliform contamination, and the groundwater beneath Site A/Plot M is not used for any purpose). The seep and stream flow in the spring does not pose a risk to human health or the environment because of low volume and intermittent flow (see the risk assessment summary in *Evaluation and Recommendation for Environmental Monitoring at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois*, GJO-2003-462-TAC, August 2003).

3.5 IEMA Independent Analysis of ANL Water Samples

In 2015 IEMA performed an independent analysis of water samples collected at the Palos Forest Preserve. Results will be made available to the public on the LM website.

4.0 Actions

1. A brick is present on the ground surface of Site A, approximately 30 yards from the monument on a compass bearing of 136 degrees.

Action: ANL will scan the brick for radiation and use the scan results to dispose of the brick appropriately.

2. Woody vegetation is encroaching on the edges of Plot M.

Action: ANL is planning to clear vegetation from the west, northwest, and northeast sides of the Plot M mound. ANL will also inform the forest preserve district that DOE is open to the idea of a controlled burn on top of Plot M in the future to address vegetation control.

3. Vegetation growth along the lower portion of the access road to Site A (near the Archer Avenue turnoff) is an ongoing issue. ANL is doing a good job of working with the Palos Forest Preserve District to maintain control of the encroaching vegetation.

Action: ANL will continue to work with the forest preserve to keep the road clear of encroaching vegetation.

4. Erosion on top of the grass-covered mound at Plot M continues to be an issue.

Action: ANL will continue to routinely inspect the grass-covered mound and repair ruts periodically by filling them in with clean dirt and reseeding.

5. Field sampling notes are not being supplied to DOE after each sampling event.

Action: Beginning in 2016, ANL will provide DOE with a copy of the field sampling notes following each sampling event.

6. The sampling point for surface location 0006 changed in 2014.

Action: ANL will walk down the intermittent stream to assess if the course is changing and if any additional seeps can be located.

7. An intermittent stream near Plot M with elevated levels of tritium crosses over a hiking trail north of Plot M.

Action: ANL is working with the forest preserve district to determine the best way to route water from the stream so that it runs beneath the hiking trail.

8. The casing of monitoring well BH35 is damaged.

Action: ANL will install a replacement well for BH35 in the next year or so.

9. Tritium concentrations and water levels in monitoring well BH6 have been fluctuating erratically since 2009.

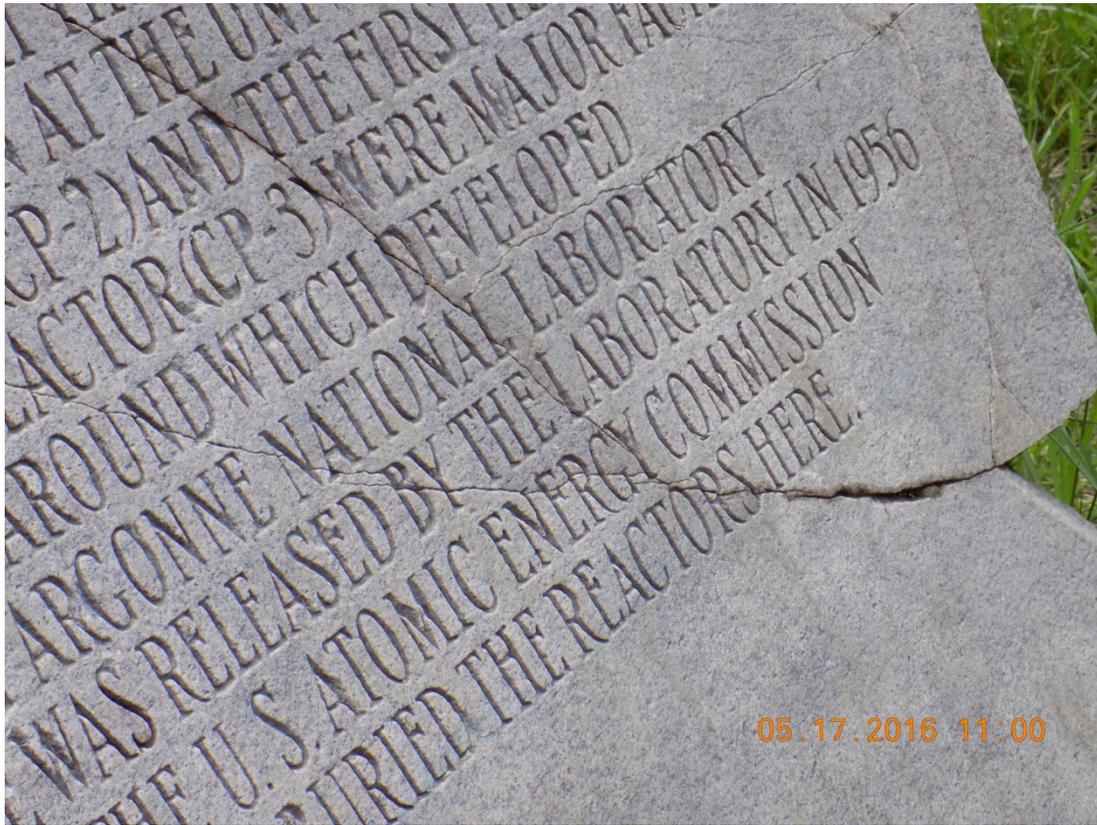
Action: ANL will look into conducting a non-invasive investigative technique to determine a possible cause for the changing conditions (e.g., ground-penetrating radar survey of the concrete cap and/or tracer tests).

5.0 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	NA	Handle removed from picnic well 5160.
PL-2	NA	Crack in Site A monument.
PL-3	NA	Monitoring well BH55.
PL-4	NA	Monitoring well BH56.
PL-5	NA	Tree at location where a brick was found.
PL-6	NA	Plot M monument.
PL-7	360	Grass growing in rut repair on top of Plot M.
PL-8	360	Grass growing in rut repair on top of Plot M.
PL-9	120	Intermittent stream crossing over hiking path north of Plot M.
PL-10	NA	Cracked casing at monitoring well BH35.



SAM 5/2016. PL-1. Handle removed from picnic well 5160.



SAM 5/2016. PL-2. Crack in Site A monument.



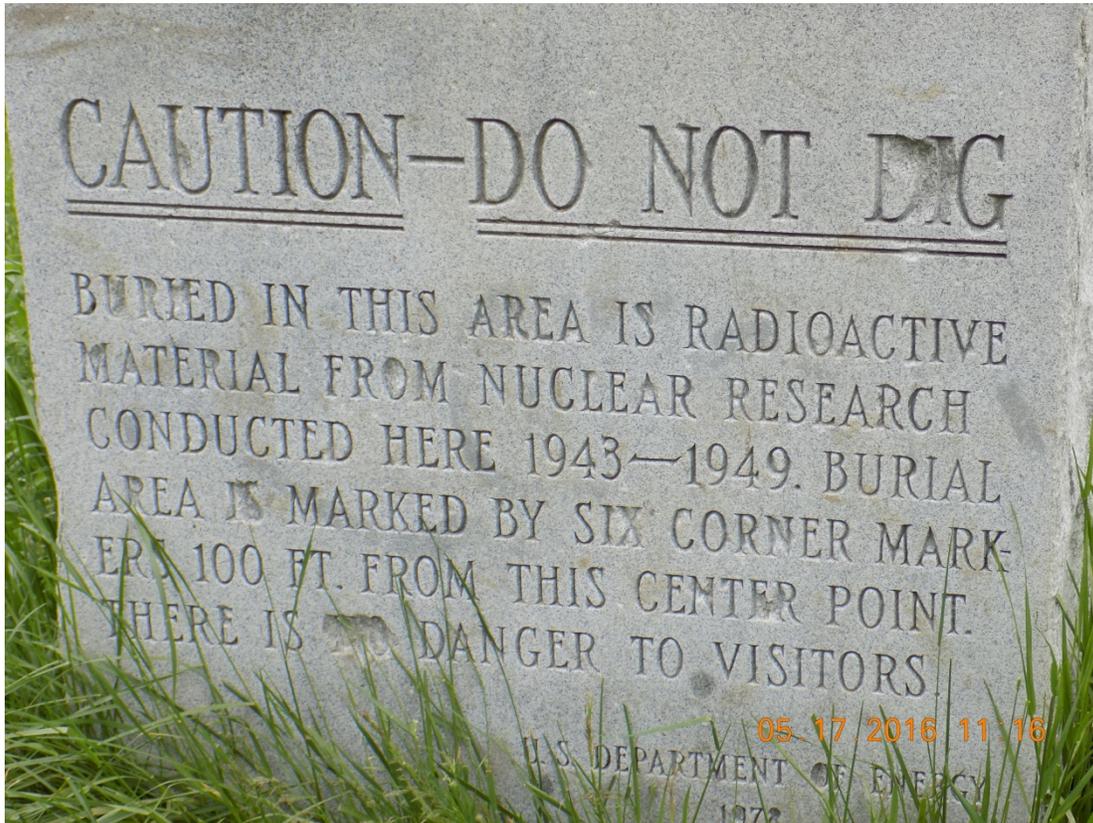
SAM 5/2016. PL-3. Monitoring well BH55.



SAM 5/2016. PL-4. Monitoring well BH56.



SAM 5/2016. PL-5. Tree at location where a brick was found.



SAM 5/2016. PL-6. Plot M monument.



SAM 5/2016. PL-7. Grass growing in rut repair on top of Plot M.



SAM 5/2016. PL-8. Grass growing in rut repair on top of Plot M.



SAM 5/2016. PL-9. Intermittent stream crossing over hiking path north of Plot M.

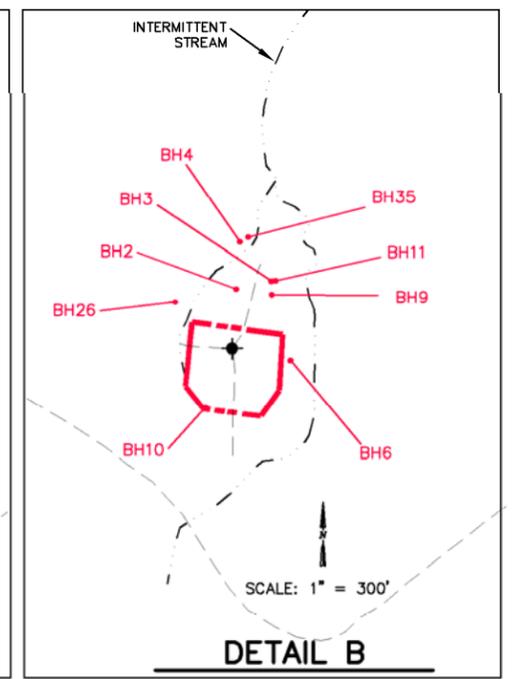
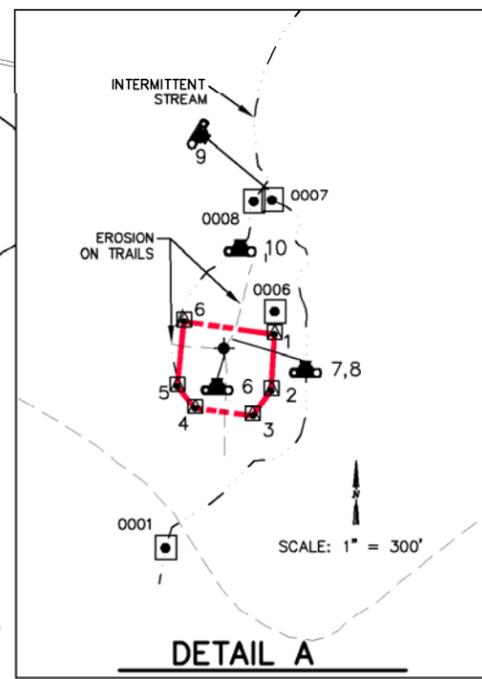
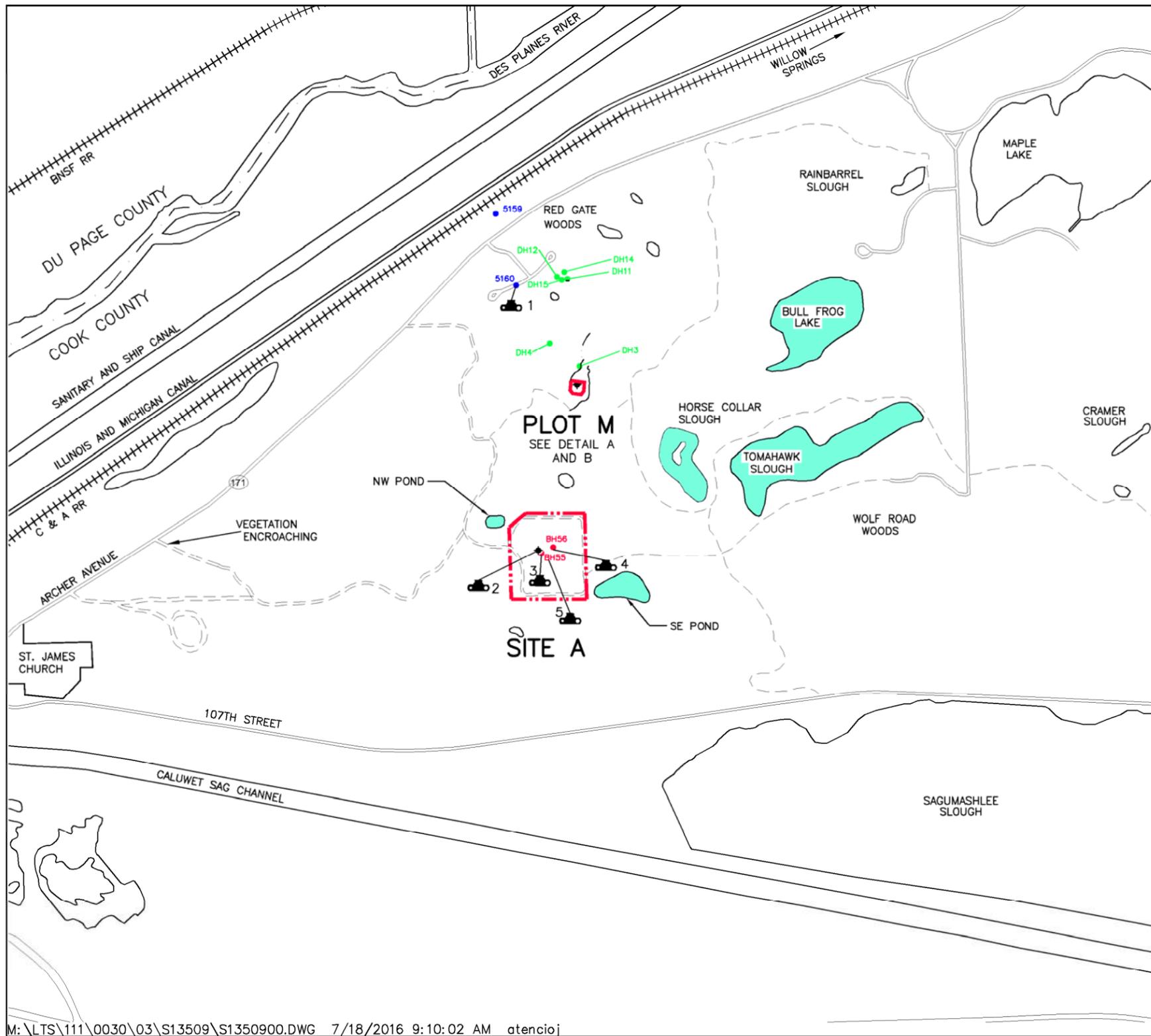


SAM 5/2016. PL-10. Cracked casing at monitoring well BH35.

Appendix A

Site Drawing

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SURFACE SAMPLING LOCATIONS

WELL LOCATIONS

EXPLANATION	
	CORNER MARKER
	5153 PICNIC WELL
	DH2 DOLOMITE WELL
	BH26 MONITORING WELL
	5 SURFACE SAMPLE LOCATION
	SITE MARKER
	SITE BOUNDARY
	DIRT ROAD
	PAVED HIGHWAY OR STREET
	INTERMEDIATE STREAM
	NON-MOTORIZED TRAIL
	RAILROAD
	RIVER, CANAL, LAKE, POND, SLOUGH
	COUNTY LINE
	PONDS THAT ARE SAMPLED
	1 PHOTO LOCATION, DIRECTION, AND NUMBER



ANNUAL INSPECTION CONDUCTED
MAY 17, 2016

		<small>Work Performed Under DOE Contract No. DE-EM0000421</small> 	
2016 ANNUAL INSPECTION DRAWING SITE A/PLOT M DECOMMISSIONED REACTOR COOK COUNTY, ILLINOIS			
DATE PREPARED:	JUNE 14, 2016	FILENAME:	S1350900

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