2016 Annual Inspection and Radiological Survey Results for the Piqua, Ohio, Decommissioned Reactor Site

July 2016

Revised October 2018
This 2016 Annual Inspection and Radiological Survey Results for the Piqua, Ohio, Decommissioned Reactor Site (LMS/PIQ/S14427) was revised in October 2018 as follows: (1) a portion of Section 2.6, “Radiological Survey,” was removed (including Table 2, “Direct/Surface Reading and Removable Activity Radiological Survey Results at the Piqua Site”); and (2) the complete radiological survey report was provided in a new Appendix B, “Radiological Survey Results.”
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Abbreviations

cm²  square centimeters
CPM  counts per minute
DOE  U.S. Department of Energy
dpm  disintegrations per minute
HVAC  heating, ventilation, and air conditioning
LM  Office of Legacy Management
µrem/h  microrems per hour
OAP  Operating Air Pressure
PL  photograph location
Summary

This report presents the findings of the annual inspection and radiological survey of the Piqua, Ohio, Decommissioned Reactor Site (site). The decommissioned nuclear power demonstration facility was inspected and surveyed on April 15, 2016. The site, located on the east bank of the Great Miami River in Piqua, Ohio, was in fair physical condition. There is no requirement for a follow-up inspection, partly because City of Piqua (City) personnel participated in a March 2016 meeting to address reoccurring safety concerns.

The 2016 radiological survey results from 104 locations revealed no removable contamination. Consistent with previous years, the highest direct beta activity reading taken was on a floor drain on the 56-foot level (1674 disintegrations per minute [dpm]/100 square centimeters [cm²]); that reading was well below the action level of 5000 dpm/100 cm².

Background

The site consists of a Containment Building and an associated Auxiliary Building. Both facilities are used by the City for storage space, shops, and offices. The City Underground Utilities Department (approximately 10 people) occupies the site.

The U.S. Department of Energy (DOE) took the initiative in 2015 to prepare a Maintenance Assistance Plan for the site. The objective of the plan is to assist the City in (1) maintaining the site in light of reoccurring inspection findings and (2) addressing the potential threat of lead-based paint and asbestos within the facilities. Furthermore, DOE conducted a utility assessment (water and electric) of the facilities in November 2015 to obtain information needed to provide current-condition site drawings. The plan also establishes a long-term maintenance schedule for continued maintenance of key items within the facilities until the site can be free-released back to the City (estimated to be in 2106).

In March of 2016, DOE met with City personnel to discuss the results of the utilities assessment and the objectives contained within the Maintenance Assistance Plan. Several of the inspection findings from previous inspections are addressed in the Maintenance Assistance Plan.
1.0 Introduction

This report presents the findings of the annual DOE inspection of the Piqua site, which is assigned to the DOE Office of Legacy Management (LM) for long-term custody and care.

The inspection on April 15, 2016, was conducted by M. Miller (Chief Inspector), K. Broberg (Assistant Inspector), and R. Mowen (Radiological Technician), all of Navarro Research and Engineering, Inc., the contractor for LM. G. Hooten (LM) and S. Dettner (Ohio Department of Health) accompanied the inspection team.

S. Johnson and J. Jamison (City Underground Utilities Department) met with inspectors during the inspection. A copy of this report will be forwarded to Mr. Johnson.

The purpose of the inspection was to confirm the integrity of the visible features at the facility and to determine if radiological or non-radiological hazards were present.

2.0 Inspection Results

Features discussed in this report are shown on the attached drawings (Appendix A). Photographs to support specific observations are identified in the text and on the drawings by photograph location (PL) numbers.

2.1 Exterior of the Containment Building

The Containment Building exterior was refurbished around 1995. The exterior surface of the Containment Building was in good condition. Items identified in the 2015 Inspection Report (i.e., exposed exterior electric wiring, broken conduits, and dismantled outlets) are listed in the Maintenance Assistance Plan.

A new minor maintenance need was observed on the exterior north wall of the Containment Building. The screen covering an exterior vent was damaged (PL-1). Unless the screen is repaired, birds could enter the building through the vent. DOE requests that the City repair the screen prior to the next annual inspection.

Vegetation around the outer base of the Containment Building continues to be a problem (PL-2 through PL-4). One area in particular has a tree growing out of the base of the building. If this vegetation is allowed to grow, it could compromise the building by enlarging cracks in the concrete, allowing water to possibly seep down into the entombment area. DOE requests that the City spray, kill, and remove this vegetation from the base of the Containment Building and properly seal the remaining cracks with a caulking compound prior to the next annual inspection.

2.2 Surrounding Area

A visual inspection was made of the area surrounding the site. No changes that could impact the integrity of the site were observed. It should be noted that in 2012 a new property survey was conducted at the site and a new survey plat of the property boundaries was produced for Facilities Information Management System purposes.
2.3 Interior

Inspectors looked for evidence of structural deterioration and entombment degradation. Concerns noted in previous inspections remain unchanged (i.e., peeling lead-based paint, falling plaster, and deteriorating pipe insulation.) These concerns are listed in the Maintenance Assistance Plan.

56-foot level: The 56-foot level is the lowest level of the Containment Building. The level is currently empty. The condition of peeling paint on the interior walls of the Containment Building remains unchanged from previous inspections (PL-5). Peeling paint (that is falling onto the floors) was analyzed in 2006 and found to contain 0.35 percent lead. The paint will probably continue to peel and fall to the floor. City personnel are aware of the presence of the lead-based paint. Abatement of the lead-based paint is being addressed in the Maintenance Assistance Plan.

A vertical drain pipe, located on the northwest wall of the 56-foot level of the Containment Building, has developed a crack and split open (PL-6 and PL-7). Inspectors traced the pipe up to the 100-foot level where it is believed to be connected to a floor drain. DOE requests that the City assess the cracked drain line and repair it if necessary prior to the next annual inspection to keep water from entering the Containment Building on the 56-foot level.

79-foot level: Interior conditions noted in previous inspections (i.e., broken plaster, peeling paint, and water damage) are unchanged. In 2013 the City cleaned out several of the rooms on this level of the Auxiliary Building and they are now being used for storage.

Evidence for water seepage (peeling paint and rust stains) along the ceiling seam of the Operating Air Pressure (OAP) room remains unchanged from previous inspections. This room is located directly above Room B-1. Evidence for water seepage from the ceiling seam of Room B-1 also remains unchanged from previous inspections. The southwest wall of both rooms is the curved wall of the Containment Building. Both rooms show evidence of water seepage along the same wall of the Containment Building. The condition is noted on the 79-foot level site inspection map and will continue to be monitored in future inspections.

Fresh moisture was present in the room next to Room B-1. Moisture at this location was also noted in the 2014 and 2015 inspections. The cause for this moisture is believed to be a crack along the base of the outer wall of the Containment Building. DOE requests that the City properly seal this crack with caulking compound prior to the next annual inspection to prevent additional moisture from seeping into the room.

83-foot level: No Concerns.

100-foot level: It was noted in 2015 and again this year that the concrete around the southwest airlock of the Containment Building needs to be repaired. Numerous cracks are present and some small pieces of concrete are falling off. DOE requests that the City evaluate the situation and make minor concrete repairs prior to next year’s inspection.

111-foot level: No Concerns.

121-foot level (Roof Top of the Auxiliary Building): Inspectors this year observed that several roof issues noted in 2015 had not been addressed. Repair of the roof fabric is identified in the Maintenance Assistance plan.
One small hole in the roof fabric was observed by inspectors this year. First identified in 2015 and again this year, if this hole is not repaired soon, it could get worse and lead to more costly repairs. DOE requests that the City repair this small hole in the roof fabric prior to next year’s inspection.

Roof drains were observed to be in much better condition this year than they were in 2015, but additional attention is needed. Vegetation is still growing around some of the drains (PL-8 and PL-9). Vegetation is also establishing itself in uncleansed corners of the roof (PL-10). DOE requests that the roof drains and roof areas be cleaned prior to next year’s inspection and kept clean so that the roof can properly drain.

2.4 Cathodic Protection System

A cathodic protection system is installed on the Containment Building to protect the steel shell. The system consists of 10 carbon (graphite) electrodes, buried radially approximately 10 feet to 20 feet from the building foundation, and a rectifier unit that provides direct-current electrical power. The rectifier unit is mounted in the break room south of and outside the airlock on the 100-foot level. Each carbon electrode is 3 inches in diameter and 60 inches long. The electrodes are connected to the rectifier unit by a header cable; splices are protected in flush-mounted boxes. A structure contact point for monitoring potential can be found on the shell associated with each electrode; some of the contact points also have cables remaining from an abandoned zinc anode protection system. The system also includes reference electrodes and test holes.

Maintenance of the cathodic protection system is specifically addressed in Contract AT(11–1)–1798, dated May 10, 1968, between the U.S. Atomic Energy Commission and the City. The City agrees to maintain the system in an operational condition as long as required to preserve the integrity of the entombed until radiological decay renders the contents safe, estimated to be approximately 50 years (2018). Maintenance requirements are not specified but include monthly inspections of the rectifier unit, recording the current and voltage output, and periodic (estimated to be every 5 years) inspections of the entire system by a qualified service provider. Operating and maintenance costs are borne by the City.

The entire system was checked by a qualified service provider in April 2010, resulting in the replacement of one of the header cables. According to the maintenance log kept with the unit, the system is being checked by plant personnel. The system is due for service by a qualified service provider. DOE requests that the City have the system serviced as soon as possible.

2.5 High-Water Alarm System

An alarm system is installed in the sump on the 56-foot level of the Containment Building to detect high water levels before they rise to the bottom of the entombed pressure vessel (PL-11). This system is designed to prevent immersion and accelerated corrosion of the pressure vessel. The alarm triggers when the sump fills to near overflow, alerting personnel to both high water and possible sump pump failure. The alarm registers in the Auxiliary Building on the Supervisory Control and Data Acquisition system, which is monitored 24 hours a day by an operator. The alarm system is included in the monthly building inspection. The Containment Building sump alarm test log indicates that the alarm is being tested monthly.
2.6 Radiological Survey

Navarro staff performed the annual radiological survey inside the Containment Building, inside the Auxiliary Building, and in exterior areas. A total of 104 sample locations were checked for both removable and surface contamination using direct measurements and smears for the detection of alpha and beta-gamma activity. Gamma exposure rates also were measured. Prior to 2008, 111 sample locations were surveyed.

In 2009, Rooms R-6 and R-7 were modified by the City. Modifications included the elimination of a connecting air duct between the two rooms. Smear sample #46 was collected from this air duct prior to 2009. Survey location #46 is now located on the floor of Room R-7 in front of the former air duct.

The highest gamma exposure rate measured throughout the facility in 2016 was 11.6 microrems per hour (µrem/h), which was 0.7 µrem/h above the outside background measurement of 10.9 µrem/h. Table 1 presents information on the instrumentation used to perform the survey.

<table>
<thead>
<tr>
<th>Type of Measurement</th>
<th>Radiation</th>
<th>Detector</th>
<th>Meter</th>
<th>Background</th>
<th>Efficiency Factor</th>
<th>Minimum Detectable Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Activity</td>
<td>Alpha</td>
<td>Ludlum 43-89 #5785</td>
<td>Ludlum 2360 #5751</td>
<td>2.0 cpm/100 cm²</td>
<td>19.74% Efficient</td>
<td>34 dpm/100 cm²</td>
</tr>
<tr>
<td>Surface Activity</td>
<td>Beta</td>
<td>Ludlum 43-89 #5785</td>
<td>Ludlum 2360 #5751</td>
<td>148 cpm/100 cm²</td>
<td>23.06% Efficient</td>
<td>352 dpm/100 cm²</td>
</tr>
<tr>
<td>Exposure Rate</td>
<td>Gamma</td>
<td>N/A</td>
<td>Eberline FH40 GL #016191</td>
<td>10.9 µrem/h</td>
<td>N/A</td>
<td>1 µrem/h</td>
</tr>
<tr>
<td>Removable Activity</td>
<td>Alpha</td>
<td>N/A</td>
<td>Ludlum 3030/ #5899</td>
<td>0.0 cpm</td>
<td>30.1% Efficient</td>
<td>6.6 dpm/100 cm²</td>
</tr>
<tr>
<td>Removable Activity</td>
<td>Beta</td>
<td>N/A</td>
<td>Ludlum 3030/ #5899</td>
<td>32.0 cpm</td>
<td>41.1% Efficient</td>
<td>95.9 dpm/100 cm²</td>
</tr>
</tbody>
</table>

Abbreviations:
cpm = counts per minute
dpm = disintegrations per minute
N/A = not applicable

Direct measurements and smear surveys were collected at 104 different locations in 2016, and the results were consistent with past years. Specific results are provided in Appendix B. The results of both direct and smear surveys were all lower than 10 CFR 835 limits for surface contamination. Consistent with previous years, the highest direct beta activity reading taken was on a floor drain on the 56 ft level (1674 dpm/100 cm²). That reading was well below the action level of 5000 dpm/100 cm², and that smear indicated no removable activity at that location.
3.0 Maintenance Action Requests

1) A screen covering a vent on the exterior wall of the Containment Building is damaged (PL-1). Unless the screen is repaired, birds could enter the building through the vent.

   Action Request: DOE requests that the City repair the screen prior to the next annual inspection.

2) Vegetation around the outer base of the Containment Building continues to be a problem (PL-2 through PL-4). One area in particular has a tree growing out of the base of the building. If this vegetation is allowed to grow, it will act to compromise the building by enlarging cracks in the concrete, allowing water to possibly seep down into the entombment area of the building.

   Action Request: DOE requests that the City kills and remove vegetation from the base of the Containment Building and properly seal the remaining cracks with a caulking compound prior to the next annual inspection.

3) A vertical drain pipe on the NW wall of the Containment Building on the 56-foot level has developed a crack and split open (PL-6 and PL-7). Inspectors traced the pipe up to the 100-foot level where it is believed to be connected to a floor drain.

   Action Request: DOE requests that the City assess the cracked drain line and repair it if necessary prior to the next annual inspection to keep water from entering the 56-foot level.

4) Fresh moisture was present in the room next to Room B-1. Moisture at this location was also noted in the 2014 and 2015 inspections. The cause for this moisture is believed to be a crack along the base of the outer wall of the Containment Building.

   Action Request: DOE requests that the City properly seal this crack with caulking compound prior to the next annual inspection to prevent additional moisture from seeping into the room.

5) One small hole in the roof fabric of the Auxiliary Building was observed by inspectors this year. First identified in 2015 and again this year, if this hole is not repaired soon, it could get worse and lead to more costly repairs.

   Action Request: DOE requests that the City repair this small hole in the roof fabric prior to next year’s inspection.

6) The concrete around the south west airlock of the Containment Building is in need of repair. Numerous cracks are present and some small pieces of concrete are falling off.

   Action Request: DOE requests that the City evaluate the situation and make minor concrete repairs prior to next year’s inspection.
7) Roof drains on the Auxiliary Building were in much better condition this year than they were in 2015, but additional attention is needed. Vegetation is still growing around some of the drains (PL-8 and PL-9). Vegetation is also establishing itself in uncleared corners of the roof (PL-10).

Action Request: DOE requests that the roof drains and roof areas be cleaned prior to next year’s inspection and kept clean so that the roof can properly drain.

8) The cathodic protection system should be serviced by a qualified service provider approximately every 5 years. It was last serviced in 2010, so the system is due for service by a qualified service provider.

Action Request: DOE requests that the City have the system serviced as soon as possible.

4.0 Photographs

<table>
<thead>
<tr>
<th>Photograph Location Number</th>
<th>Azimuth</th>
<th>Elevation Level</th>
<th>Photograph Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL-1</td>
<td>NA</td>
<td>Ground Level</td>
<td>Missing vent screen.</td>
</tr>
<tr>
<td>PL-2</td>
<td>45</td>
<td>Ground Level</td>
<td>Small tree – base of containment building.</td>
</tr>
<tr>
<td>PL-3</td>
<td>220</td>
<td>Ground Level</td>
<td>Vegetation – base of containment building.</td>
</tr>
<tr>
<td>PL-4</td>
<td>180</td>
<td>Ground Level</td>
<td>Weeds – base of containment building.</td>
</tr>
<tr>
<td>PL-5</td>
<td>140</td>
<td>56 ft.</td>
<td>Peeling paint.</td>
</tr>
<tr>
<td>PL-6</td>
<td>338</td>
<td>56 ft.</td>
<td>Cracked drain pipe.</td>
</tr>
<tr>
<td>PL-7</td>
<td>338</td>
<td>56 ft.</td>
<td>Cracked drain pipe.</td>
</tr>
<tr>
<td>PL-8</td>
<td>338</td>
<td>121 ft.</td>
<td>Roof drain.</td>
</tr>
<tr>
<td>PL-9</td>
<td>60</td>
<td>121 ft.</td>
<td>Roof drain.</td>
</tr>
<tr>
<td>PL-10</td>
<td>180</td>
<td>121 ft.</td>
<td>Corner of roof.</td>
</tr>
<tr>
<td>PL-11</td>
<td>338</td>
<td>56 ft.</td>
<td>Sump pump area.</td>
</tr>
</tbody>
</table>


Appendix A

Site Drawings
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ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED
APRIL 15, 2016

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL.
SMEAR/DIRECT LOCATIONS ON THE 79-FOOT LEVEL IN CONTAINMENT STRUCTURE:

- 24-FLOOR
- 25-FLOOR
- 26-FLOOR
- 27-FLOOR
- 111-IN HVAC DUCT
- 74-FOOT LEVEL

"DAP" (OPERATING AIR PRESSURE) ROOM REMODELED IN 2009. PAINTED AND SHELVES WERE ADDED.

NOTE THAT THIS SECTION OF THE WALL WAS REMOVED IN 2009.

PLANT - 79 FOOT LEVEL

SMEAR/DIRECT LOCATIONS ON THE 79-FOOT LEVEL IN AUX. BLDG.:

- 51-FLOOR
- 52-FLOOR
- 53-FLOOR
- 54-ON DRAIN
- 55-FLOOR
- 56-FLOOR
- 57-FLOOR
- 58-ON DRAIN
- 59-FLOOR
- 60-FLOOR
- 61-ON DRAIN
- 62-ON SUMP COVER
- 63-PUMP
- 64-FLOOR UNDER TANK
- 65-FLOOR
- 66-FLOOR
- 67-HOSE HVAC ON FLOOR
- 68-FLOOR
- 69-FLOOR - 89' LEVEL GAP ROOM

ANNUAL INSPECTION AND RADILOGICAL SURVEY CONDUCTED
APRIL 15, 2016

2016 ANNUAL INSPECTION AND RADILOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO

DATE PREPARED: JUNE 07, 2016
FILENAME: S1350300
SAME DRAIN PIPE THAT IS CRACKED ON 56 FOOT LEVEL 2016 INSPECTION

28-ON TOP OF HVAC UNIT
29-GRATING ON PLATFORM
30-PIPE ADJACENT TO PLENUM
31-IN DUCT
32-FLOOR GRATING
33-PUMP PEDESTAL
34-IN DRAIN
35-IN DRAIN
36-PUMP PEDESTAL
37-STAIRWELL

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED APRIL 15, 2016

15 7.5 0 15 30
SCALE IN FEET

INSTRUMENT  LUDLUM 2360  LUDLUM 3030
SERIAL #  5751/5785  5999
CAL. DUE  3-15-17  3-14-2017  3-14-2017

EFFECTIVENESS  

\[ \text{\# Eff.} \times \text{32.0 CPM} \]
\[ \text{\# Eff.} \times \text{32.0 CPM} \]
\[ \text{\# Eff.} \times \text{32.0 CPM} \]
\[ \text{\# Eff.} \times \text{32.0 CPM} \]

BACKGROUND:

\[ \text{\# Eff.} \times \text{32.0 CPM} \]
\[ \text{\# Eff.} \times \text{32.0 CPM} \]
\[ \text{\# Eff.} \times \text{32.0 CPM} \]

KEY:

ND = GENERAL AREA EXPOSURE RATE
ND = CONTACT EXPOSURE RATE
ND = SMEAR/DIRECT LOCATION

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL

U.S. Department of Energy 2016 Annual Inspection - Piqua, OH, Decommissioned Reactor Site
July 2016

Doc. No. S1447
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SMEAR/DIRECT LOCATIONS ON THE 100-FOOT LEVEL IN CONTAINMENT STRUCTURE

100-FOOT LEVEL IN AUX. BLDG.

- 38-FLOOR
- 39-FLOOR
- 40-FLOOR
- 41-FLOOR
- 42-FLOOR
- 43-FLOOR
- 44-FLOOR
- 45-ON DRAIN
- 46-ON FLOOR
- 50-AIRLOCK FLOOR
- 105-ON DRAIN

SMEAR/DIRECT LOCATIONS OUTSIDE

- 106-CONCRETE FLOOR
- 107-CONCRETE WALL
- 108-FLOOR UNDER FLANGE
- 109-CONCRETE FLOOR
- 110-CONCRETE FLOOR
- 9-CONCRETE FLOOR

FLOOR DRAIN BELIEVED TO BE ASSOCIATED WITH CRACKED DRAIN PIPE ON 56-FOOT LEVEL

ROOMS R-6 AND R-7 REMODELED IN 2009. WALLS PAINTED, SHELVES ADDED, AND THE AIR DUCT BETWEEN THE TWO ROOMS WAS REMOVED.

NEW EPOXY FLOORS INSTALLED IN ROOMS 115 AND 121-A IN 2009.

NEW A/C UNIT INSTALLED IN ROOM 121-A IN 2009.

EXPLANATION:
- GRAPHITE ANODES
- PHOTO LOCATION, ROTATION, AND NUMBER

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED
APRIL 15, 2016

2016 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO
DATE PREPARED: JUNE 07, 2016
FILE NAME: S1350300

2016 Annual Inspection - Piqua, OH, Decommissioned Reactor Site
Doc. No. S14427
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SMEAR/DIRECT LOCATIONS ON THE 111-FOOT LEVEL IN CONTAINMENT STRUCTURE

- 47-FLOOR
- 48-FLOOR
- 49-FLOOR
- 50-FLOOR
- 51-FLOOR
- 52-FLOOR
- 53-FLOOR
- 54-FLOOR
- 55-FLOOR
- 56-FLOOR
- 57-FLOOR
- 58-FLOOR
- 59-FLOOR
- 60-FLOOR
- 61-FLOOR
- 62-FLOOR
- 63-FLOOR
- 64-FLOOR
- 65-FLOOR
- 66-FLOOR
- 67-FLOOR
- 68-FLOOR
- 69-FLOOR
- 70-FLOOR
- 71-FLOOR
- 72-FLOOR
- 73-FLOOR
- 74-FLOOR
- 75-FLOOR
- 76-FLOOR
- 77-FLOOR
- 78-FLOOR
- 79-FLOOR
- 80-FLOOR
- 81-FLOOR

SMEAR/DIRECT LOCATIONS ON THE 111-FOOT LEVEL IN THE AUX. BLDG.

- 47-FLOOR
- 48-FLOOR
- 49-FLOOR
- 50-FLOOR
- 51-FLOOR
- 52-FLOOR
- 53-FLOOR
- 54-FLOOR
- 55-FLOOR
- 56-FLOOR
- 57-FLOOR
- 58-FLOOR
- 59-FLOOR
- 60-FLOOR
- 61-FLOOR
- 62-FLOOR
- 63-FLOOR
- 64-FLOOR
- 65-FLOOR
- 66-FLOOR
- 67-FLOOR
- 68-FLOOR
- 69-FLOOR
- 70-FLOOR
- 71-FLOOR
- 72-FLOOR
- 73-FLOOR
- 74-FLOOR
- 75-FLOOR
- 76-FLOOR
- 77-FLOOR
- 78-FLOOR
- 79-FLOOR
- 80-FLOOR
- 81-FLOOR

SMEAR/DIRECT LOCATIONS ON THE OUTSIDE ON ROOF

- 47-FLOOR
- 48-FLOOR
- 49-FLOOR
- 50-FLOOR
- 51-FLOOR
- 52-FLOOR
- 53-FLOOR
- 54-FLOOR
- 55-FLOOR
- 56-FLOOR
- 57-FLOOR
- 58-FLOOR
- 59-FLOOR
- 60-FLOOR
- 61-FLOOR
- 62-FLOOR
- 63-FLOOR
- 64-FLOOR
- 65-FLOOR
- 66-FLOOR
- 67-FLOOR
- 68-FLOOR
- 69-FLOOR
- 70-FLOOR
- 71-FLOOR
- 72-FLOOR
- 73-FLOOR
- 74-FLOOR
- 75-FLOOR
- 76-FLOOR
- 77-FLOOR
- 78-FLOOR
- 79-FLOOR
- 80-FLOOR
- 81-FLOOR

INSTRUMENT: LUDLUM 3360

SERIAL #: 5761/5765
CAL.: 11/16

EFFECTIVENESS:
- P.EFF.: 19.75%
- P.EFF.: 23.08%
- P.EFF.: 41.12%

BACKGROUND:
- 0.0 CPM
- 1400 CPM

STORAGE

PLAN - 111 FOOT LEVEL

- W-Balcony
- C-Storage

SURVEYED BY: DATE:
ROY L. MORRIS 4/15/16

REVIEWED BY: DATE:

NOTE: SAMPLE 1-5 WERE DELETED BECAUSE HVAC EQUIPMENT HAS BEEN REMOVED FROM ROOF.

HIGHEST GAMMA READING ON THIS LEVEL WAS 0.7 µrem/hr ABOVE BKGD.

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED APRIL 15, 2016

2016 Annual Inspection - Piqua, OH Decommissioned Reactor Site Page A-7
SMEAR/DIRECT LOCATIONS ON THE 121-FOOT LEVEL IN THE AUX. BLDG.

70-LEVEL
71-LEVEL
72-LEVEL
73-LEVEL
74-LEVEL
75-LEVEL

PLAN - 121 FOOT LEVEL

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL.

2016 ANNUAL INSPECTION AND RADILOGICAL SURVEY CONDUCTED APRIL 15, 2016

PIQUA, OHIO

DATE PREPARED: JUNE 07, 2016

FILENAME: S1350300.DWG

7/11/2016 1:56:41 PM ateniloy
Appendix B

Radiological Survey Results
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### Radiological Survey Map

**Radiological Work Permit No.:** N/A  
**Purpose:** Yearly Survey  
**Location:** Piqua, Ohio  
**Technician:** Ray Mower  
**Date:** 4-15-16  
**Reviewer:**  
**Date:** 2016/11/02  

#### Instrument 1
- **Instrument/Probe Model:** Leaxam 2360/43-89
- **Instrument Serial No.:** 5785
- **Probe Serial No.:** 5785
- **Calibration Due:** 3-15-17
- **Efficiency:**  α 19.74%, β 33.06%
- **BKGD (cpm):** α 2, β 148
- **Area Probe Correction Factor:** 1

#### Instrument 2
- **Instrument/Probe Model:** Leaxam 3030
- **Instrument Serial No.:** 5899
- **Probe Serial No.:** N/A
- **Calibration Due:** 3-14-17
- **Efficiency:** α 30.1%, β 41.1%
- **BKGD (cpm):** α 0, β 32
- **Area Probe Correction Factor:** N/A

#### Instrument 3
- **Instrument Model:** Eberline FH 40 G-L
- **Instrument Serial No.:** 5016191
- **Probe Serial No.:** N/A
- **Calibration Due:** 3-18-17
- **Background:** 10.9 mrem/hr

---

**Standard Symbols for Surveys**
- Tape press (4"x4") (no. inside)
- Smears (no. inside)
- Large area smears
- Air samples (no. inside)
- Neutron readings in mrem/hr unless otherwise noted
- Gamma readings in µrem/hr unless otherwise noted (beta readings also)
- Contact readings (dose rate)
- Hot spot
- Step-off pad
- Reading at knee level (when sources from overhead)
- Reading at head level (when sources from overhead)
- Contaminated area
- Radiation area
- Contaminated/radiation area
- Radioactive material area
- Floor drain
- Corrected or net cpm (gross background) for direct frisk, alpha or beta/gamma specified

---

**SEE ATTACHED MAPS FOR LOCATIONS**

---

**LMS 1553**  
10/19/2015
## Radiological Survey Map (continued)

<table>
<thead>
<tr>
<th>Item Surveyed</th>
<th>Location Surveyed</th>
<th>Gross Counts</th>
<th>Direct Survey</th>
<th>Activity¹</th>
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### Applicable Limits (check one for alpha and one for beta)

- **Alpha (removable/total):**
  - [ ] 1000/5000
  - [ ] 200/1000
  - [ ] 20/500

- **Beta (removable/total):**
  - [ ] 1000/5000
  - [ ] 200/1000

### Activity Equation

- **Gross count minus BKGD count = Net count**
- **Net count/Eff = dpm**
- **Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm²**

### Remarks:

- **PIQUA SURVEY**
- **61st ANNUAL**

### Released To:

- [ ] Unrestricted
- [ ] Restricted
- [ ] Other (see remarks)

### Release:

- [ ] Unrestricted
- [ ] Restricted
- [ ] Other (see remarks)

---

[¹See Table 2–2 of Site Radiological Control Manual (LMS/POL/S04322).]

**Page: B-2**

LMS 1553
10/13/2015

2016/11/02
### Radiological Survey Map (continued)

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**Applicable Limits (check one for alpha and one for beta)**

**Alpha (removable/total):**
- 1000/5000
- 200/1000
- 20/500

**Beta (removable/total):**
- 1000/5000
- 200/1000

**Activity Equation**

\[
\text{Gross count minus BKGD count} = \text{Net count}
\]

Net count/Eff = dpm

Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm<sup>2</sup>

**APCF**

- 44-9 = 6.5
- FHZ 732 (GM) = 6.5
- 43-10-1 = 1

**Remarks:**

- **ANNUAL PIQUA SURVEY**

**Released To:**

- ☐ Unrestricted
- ☐ Restricted
- ☐ Other (see remarks)

*See Table 2-2 of Site Radiological Control Manual I (LMS/POL/S04322).
## Radiological Survey Map (continued)

<table>
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<th>Item Surveyed</th>
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<th>Gross Counts</th>
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### Applicable Limits (check one for alpha and one for beta)

- **Alpha (removable/total):**
  - 1000/5000
  - 200/1000
  - 20/500

- **Beta (removable/total):**
  - 1000/5000
  - 200/1000

### Activity Equation

\[
\text{Gross count} - \text{BKGD count} = \text{Net count}
\]

\[
\text{Net count} = \frac{\text{dpm}}{\text{Area Probe Correction Factor (APCF)}} = \frac{\text{dpm}}{100 \text{ cm}^2}
\]

### Remarks

**Annual Piqua Survey**

### Released To:

- **Unrestricted**
- **Restricted**
- **Other (see remarks)**

---

*See Table 2-2 of Site Radiological Control Manual I (LMS/POL/S04322).*
### Radiological Survey Map (continued)

<table>
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<tr>
<th>Item Surveyed</th>
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### Applicable Limits (check one for alpha and one for beta)
- Alpha (removable/total): 1000/5000 200/1000 20/500
- Beta (removable/total): 1000/5000 200/1000

### Remarks:
Annual Pluma Survey

### LPM x Area Probe Correction Factor (APCF) = dpm/100 cm²
- APCF 44.9 = 6.5
- FHZ 73 (GM) = 6.5
- 43-10-1 = 1

### Released To:
- □ Unrestricted
- □ Restricted
- □ Other (see remarks)

**Release:**
- □ Unrestricted
- □ Restricted
- □ Other (see remarks)

---

See Table 2-2 of Site Radiological Control Manual I (LMS/POL/S04322).
## Radiological Survey Map (continued)

### Direct Survey

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### Smear Survey

<table>
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<tr>
<th>Gross Counts</th>
<th>Net Counts</th>
<th>Activity</th>
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<tbody>
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</table>

### Applicable Limits (check one for alpha and one for beta)

- **Alpha (removable/total):**
  - 1000/5000
  - 200/1000
  - 20/5000
- **Beta (removable/total):**
  - 1000/5000
  - 200/1000

### Activity Equation

- Gross count minus BKGD count = Net count
- Net count/EF = dpm
- Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm²

### Remarks

- **ANNUAL PIQUA SURVEY**

### Released To:

- Unrestricted
- Restricted
- Other (see remarks)

---

**Release:** 3 crossout/ correction

**Remarks:** Grossout mistake/correction

---

**LMS 1553**
03/12/2013

---

**20130415 - PIQ - 01**

---

**Page B-6**
<table>
<thead>
<tr>
<th>Item Surveyed</th>
<th>Location Surveyed</th>
<th>Direct Survey</th>
<th>Smear Survey</th>
<th>Activity Equation</th>
<th>Inst. No. Used</th>
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**Applicable Limits (check one for alpha and one for beta)**

<table>
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<tr>
<th></th>
<th>Alpha (removable/total)</th>
<th>Beta (removable/total)</th>
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<tbody>
<tr>
<td>α</td>
<td>[ ] 1000/5000</td>
<td>[✓] 1000/5000</td>
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<tr>
<td>β</td>
<td>[✓] 200/1000</td>
<td>[ ] 200/1000</td>
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</table>

**Activity Equation**

Gross count minus BKGD count = Net count
Net count/Eff = dpm
Dpm x Area Probe Correction Factor (APCF) = dpm/100 cm²

**APCF**

44-9 = 6.5
FHZ 732 (GM) = 6.5
43-10-1 = 1

**Remarks:**

ANNUAL AQUA SURVEY

**Release:**  
[ ] Unrestricted  [ ] Restricted  [✓] Other (see remarks)

See Table 2-2 of Site Radiological Control Manual 1 (LMS/POL/04322).

LMS 1553  
03/12/2013

Page B-7
SMEAR/DIRECT LOCATIONS ON THE 56-FOOT LEVEL:

10. FLOOR
11. FLOOR
12. FLOOR
13. FLOOR
14. FLOOR
15. FLOOR
16. IN FLOOR DRAIN
17. FLOOR
18. ON PERFECT
19. ON FLOOR DRAIN
20. SUMP DRAINING
21. ON VENT BY STAIRWELL
22. ON FLOOR DRAIN
23. ON FLOOR DRAIN
24. ON FLOOR DRAIN
25. IN FLOOR DRAIN
26. IN FLOOR DRAIN
27. IN FLOOR DRAIN
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193. IN FLOOR DRAIN
194. IN FLOOR DRAIN
195. IN FLOOR DRAIN
196. IN FLOOR DRAIN
197. IN FLOOR DRAIN
198. IN FLOOR DRAIN
199. IN FLOOR DRAIN
200. IN FLOOR DRAIN

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL.
SMEAR/DIRECT LOCATIONS ON THE 79-FOOT LEVEL IN AUX. BLDG.

INSTRUMENT

LUDLUM 2380
LUDLUM 3030

SERIAL #
5730/5765
5790

CAL. DUE
3-16-17
3-14-2017
3-18-2017

EFFICIENCY
EFF. 19.74%
EFF. 30.1%
EFF. 41.1%

BACKGROUND
2 CPM
1 1/2 CPM
1 3/2 CPM

NOTE:
- ALL 2016 GAMMA READINGS < 5KIDG ON THIS LEVEL

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED
APRIL 15, 2016

DATE PREPARED:
JUNE 07, 2016
FILENAME:
S13503000

U.S. Department of Energy
July 2016

2016 Annual Inspection - Piqua, OH, Decommissioned Reactor Site
Doc. No. S14427
Page A-4

Page B-10
PLAN - 83 FOOT LEVEL

SMEAR/DIRECT LOCATIONS ON THE 83-FOOT LEVEL:
28-On Top of HVAC Unit
29-Grating on Platform
30-Pipe Adjacent to Plenum
31-In Duct
32-Floor Grating
33-Pump Pedestal
34-In Drain
35-In Drain
36-Pump Pedestal
37-Stairwell

SAME DRAIN PIPE THAT IS CRACKED ON 56 FOOT LEVEL.

3 WAY SPLIT
DRAIN PIPE THAT IS CRACKED ON 56 FOOT LEVEL.

INSTRUMENT
LUDLUM 2300
LUDLUM 3300

SERIAL #
5790.3785
5889

CAL DUE
3-18-17
3-14-2017
3-18-2017

EFFICIENCY
a eff. 19.74%
t eff. 19.74%
t eff. 19.74%

BACKGROUND
n eff. 30.15%
t eff. 41.15%
N/A

REVIEWED BY:
DATE:

SURVEYED BY:
DATE:

EFFECTIVE
a eff. 23.06%
t eff. 41.15%
N/A

NOTE: ALL 2016 GAMMA READINGS WERE < BKGD. ON THIS LEVEL.

DATE: JUNE 07, 2016
FILENAMES: ST3503000.DWG
SMEAR/DIRECT LOCATIONS ON THE 100-FOOT LEVEL IN CONTAINMENT STRUCTURE

38-FLOOR
39-FLOOR
40-FLOOR
41-FLOOR
42-FLOOR
43-FLOOR
44-FLOOR
45-ON DRAIN
46-ON FLOOR
50-AIRLOCK FLOOR
105-ON DRAIN

FLOOR DRAIN BELIEVED TO BE ASSOCIATED WITH DRAPPED DRAIN PIPE ON 96-FOOT LEVEL

ROOMS R-6 AND R-7 WERE REMODELED IN 2009. WALLS WERE PAINTED, SHELVES ADDED, AND THE AIR DUCT BETWEEN THE TWO ROOMS WAS REMOVED.

NEW EPOXY FLOORS INSTALLED IN ROOMS 115 AND 121-A IN 2009.
NEW A/C UNIT INSTALLED IN ROOM 121-A IN 2009.

NEW RECLAMATION OF ROOMS 115 AND 121-A IN 2009.

GRAPHITE ANODES

PLAN - 100 FOOT LEVEL

SMER/DIRECT LOCATIONS OUTSIDE

106-CONCRETE FLOOR
107-CONCRETE WALL
106-CONCRETE FLOOR
109-CONCRETE FLOOR
9-FLOOR

INSTRUMENT
LUDLUM 2360
LUDLUM 3020

SERIAL #
5776/5785
5899

CAL. DUE
3-15-17
3-14-17
3-14-17

EFFICIENCIES
a EFF. 19.0%
a EFF. 23.0%
a EFF. 41.0%
15.0%

BACKGROUND
= 2.5 CPM
= 0.0 CPM
= 10.9 CPM/hr
= 10.9 CPM/hr

KEY:
= GENERAL AREA EXPOSURE RATE (rem/hr)
= CONTACT EXPOSURE RATE (rem/hr)

SU REVIEWED BY:
ROY L. WOEN
4/16/16

DATE:
4/16/16

ANNUAL INSPECTION AND RADILOGICAL SURVEY CONDUCTED
APRIL 16, 2016

U.S. Department of Energy
July 2016
SMEAR/DIRECT LOCATIONS ON THE 111-FOOT LEVEL IN CONTAINMENT STRUCTURE
47-LEVEL
48-LEVEL
49-LEVEL

SMEAR/DIRECT LOCATIONS ON THE 111-FOOT LEVEL IN THE AUX. BLDG.
6-ON CONCRETE PLATFORM
7-ON CONCRETE PLATFORM
8-ON CONCRETE PLATFORM
9-ON VENT DUCT
10-FLOOR

SMEAR/DIRECT LOCATIONS ON THE OUTSIDE ON ROOF
76-LEVEL
77-LEVEL
78-LEVEL
79-LEVEL
80-LEVEL

INSTRUMENT SERIAL # CAL. DUE EFFICIENCIES
LUDLUM ZMD 3/38 3/15-17 12.8 N/C 12.8 N/E 12.8 N/A

BACKGROUND EXPOSURE RATE (cpr/hr)
+ 3 cpm 3.14 cpm 3.125 cpm
- 10.6 cpm

KEY:
NO. = GENERAL AREA EXPOSURE RATE (cpr/hr)
HIGHEST GAMMA READING ON THIS LEVEL WAS 67.7 cpr/hr ABOVE BG RD.
NOTE: SAMPLES 1-5 WERE DELETED BECAUSE HVAC EQUIPMENT HAS BEEN REMOVED FROM ROOF.

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED APRIL 15, 2016

SURVEYED BY: DATE:
REVIEWS BY: DATE:

M:\111\0027\5\013000\01350300.DWG 7/11/2016 2:00 PM aelerik
SMEAR/DIRECT LOCATIONS ON THE 121-FOOT LEVEL IN THE AUX. BLDG.

70-LEVEL
71-LEVEL
72-LEVEL
73-LEVEL
74-LEVEL
75-LEVEL

PLAN - 121 FOOT LEVEL

INSTRUMENT SERIAL CAL. DUE EFFICIENCIES BACKGROUND KEY:

<table>
<thead>
<tr>
<th>INSTRUMENT Brand, Model, Serial No.</th>
<th>SERIAL #</th>
<th>CAL. DUE</th>
<th>EFFICIENCIES</th>
<th>BACKGROUND</th>
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<tbody>
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<td>3/04-17</td>
<td>≤ EFF. 15%, ≤ EFF. 15%</td>
<td>≤ 0.5 CPM</td>
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<tr>
<td>Ludlum 3030</td>
<td>0/20/2017</td>
<td>3/04-17</td>
<td>≤ EFF. 15%, ≤ EFF. 15%</td>
<td>≤ 0.5 CPM</td>
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NOTE: ALL 2016 GAMMA READINGS WERE < BKGD ON THIS LEVEL.

ANNUAL INSPECTION AND RADIOPHYSICAL SURVEY CONDUCTED APRIL 18, 2016

SURVEYED BY: ROY L. WOMEN 4/15/16
REVIEWED BY:  

DATE:  

2016/11/02

U.S. Department of Energy
July 2016