LMS/PIQ/S30770

2020 Annual Inspection and Radiological Survey Results for the Piqua, Ohio, Decommissioned Reactor Site

August 2020

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Contents

Table

Appendixes

Abbreviations

CFR	*Code of Federal Regulations*
cm^2	square centimeters
DOE	U.S. Department of Energy
dpm	disintegrations per minute
ft	feet
LM	Office of Legacy Management
LMS	Legacy Management Support
µrem/h	microrem per hour
OAP Room	Operating Air Pressure Room
PL	photograph location

Executive Summary

This report presents the findings of the annual inspection and radiological survey of the Piqua, Ohio, Decommissioned Reactor Site (site). In accordance with the site's Long-Term Surveillance and Maintenance Plan the facility was inspected and surveyed for radiation on June 23, 2020. The site, on the east bank of the Great Miami River in Piqua, Ohio, is in fair physical condition. No evidence of wildlife in the facility, vandalism, or trespassing was observed during this year's inspection.

The 2020 inspection was conducted safely during the COVID-19 pandemic to ensure the field inspection met the expectation of the Ohio Department of Health COVID-19 orders, and Office of Legacy Management (LM) Phase 2 COVID-19 requirements.

Radiological survey results in 2020 were consistent with the historical survey results. One direct beta radiation activity reading in a floor drain on the 56-foot level read 688 disintegrations per minute (dpm) per 100 square centimeters (cm^2), which is also consistent with past results and well below the action level of 5000 dpm/100 cm^2.

The City of Piqua vacated the facility in the fall of 2018. LM is now responsible for facility maintenance per the contract and lease amendments. In light of the vacancy, a monthly protectiveness assessment is conducted until such time that LM determines the long-term site usage.

The four key deficiencies, noted since the 2018 inspection, remain.

1. The sump pump, which keeps water out of the basement of the Reactor Building, has been out of service since 2018. In addition, the high water alarm to the sump pump has been removed. Both of these protective assets require replacement. An assessment was released in December of 2018 that recommended reinstalling the high-water level alarm system and replacing the sump pump. Both recommendations were based on the assumption that the current decommissioned state of the facility would not change. These recommendations though are currently under deferment, until a decision has been made concerning the long-term state of the site. In the interim, since the facility is not occupied on a routine basis, the water has been shut off to prevent any spills or leaks, thereby reducing the impact of the inoperable sump pump.
2. The heat pump that heats the facility has been out of service since 2017 and needs to be repaired or replaced if the facility is to be reoccupied. Because the site is unoccupied and the utilities (electric and water) have been shut off, this deficiency does not present a protectiveness concern for the site or entombment.
3. The primary waterline break in the former reactor facility fire suppression system was repaired prior to the 2018 inspection; however, the fire suppression lines throughout the facilities and sprinkler heads remain untested. Since verification testing has not been completed, the fire suppression system has not been verified as operable. This is not a protectiveness concern as the facility is unoccupied and the water has been shut off.
4. The cathodic protection system remains inoperable due to electricity being cut off from the building. This is unlikely to have an impact on the integrity of the dome in the short-term, while a decision regarding the long-term state of the site is being made.

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1.0 Introduction

This report presents the findings of the annual U.S. Department of Energy (DOE) inspection and radiological survey of the Piqua, Ohio, Decommissioned Reactor Site, which is assigned to the Office of Legacy Management (LM) for long-term custody and care.

Navarro Research and Engineering, Inc. (Navarro), as the Legacy Management Support (LMS) contractor, conducted the site inspection and radiological survey on June 23, 2020. The LM site manager and three Ohio Department of Health employees accompanied the inspection team. Although the City of Piqua vacated the facility in 2018, the city remains a current stakeholder, and will be sent a copy of this report including the DOE inspection report and radiological survey results.

The purpose of the inspection was to assess the general conditions of the site and to ensure that the entombment remains in a protective state until radiation limits defined in Title 10 *Code of Federal Regulations* Section 20 (10 CFR 20) have been reached. Radiological activity within the facility was also assessed against limits for occupational radiation protection defined in 10 CFR 835.

1.1 Background

The site consists of a Containment Building and an associated Auxiliary Building. Both buildings had been used by city workers as storage spaces, workshops, and offices. The city vacated the facility in 2018, and the site is currently unoccupied. LM is responsible for site maintenance and is in the process of determining what the long-term state of the site.

Utilities (electric and water) to the Piqua facility were turned off in 2019 to facilitate an asbestos abatement project and both remain off. The 2020 inspection was conducted using flashlights in areas where natural light was not available. This condition limited photos taken for the inspection to outside areas or areas in the Auxiliary Building near windows.

2.0 Inspection Results

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

2.1 Exterior of the Containment Building

The Containment Building exterior was refurbished circa 1995. The building's exterior surface is in overall good condition, but the paint is fading and beginning to peel in a few areas (PL-1). Some exterior electrical safety concerns identified in the 2015 site utility assessment (e.g., exposed exterior electrical wiring, broken conduits, and dismantled outlets) remain, electric power to the facility has been turned off. For instance, there is exposed conduit outside the Containment Building. The break in the fire suppression line was repaired by the city in 2018, but the fire suppression system itself (e.g., sprinkler heads) was not verified as operable. Since verification testing has not been completed, the fire suppression system is considered inoperable.

2.2 Surrounding Area

The area surrounding the site was visually observed. The city's wastewater expansion project (located southeast of the site) was mostly completed. The road leading to the wastewater plant facility was recently repaved (PL-2). A new retaining wall was constructed between the treatment plant expansion and the Auxiliary Building (PL-3). No changes that could impact the integrity of the site or the entombment were observed.

2.3 Interior

Inspectors looked for evidence of structural deterioration and entombment degradation. Concerns noted in previous inspections that are not related to structural deterioration and entombment degradation remain unchanged (e.g., peeling lead-based paint, falling plaster, and deteriorating pipe insulation with asbestos containing material). It should be noted that only those inspection items that could potentially compromise the entombment will be addressed since the long-term state of the facility is currently being evaluated.

56-foot level: The 56-foot (ft) level is the lowest level of the Containment Building. Paint flakes continue to fall from the interior walls onto the floors—a condition that remains unchanged from previous inspections. Paint in the facility is lead based (DOE 2017).

The 2016 site inspection report noted that a vertical drainpipe on the northwest wall of the Containment Building's 56 ft level had developed a small crack and split open. Inspectors traced the pipe to the 100 ft level, where it connects to a floor drain. Inspectors noted during this year's inspection that the cracked pipe and its surrounding area were dry. Because the floor drain is in part of the 100 ft level that does not encounter water, it is unlikely that water will enter the pipe from the 100 ft level. Inspectors will continue to check for water around the exterior of this pipe on the 56 ft level.

A sump pump is located in the floor of the 56 ft level. LM personnel were notified on April 5, 2018, that the sump pump was not operational. The sump pump was pulled and surveyed for radiological activity on May 23, 2018. No radiological activity was detected on the pump, and it was identified as eligible for disposal as sanitary waste. A 2018 assessment recommended that the sump pump be replaced (DOE 2018). Replacement of the sump pump is currently on hold, until a decision has been made concerning the long-term state of the site. The water to the facility has been shut off, greatly reducing the potential need for sump pump operation. During the June 2020 inspection, the sump pump was dry.

79-foot level: Interior conditions noted in the Auxiliary Building in previous inspections (e.g., broken plaster, peeling paint, and water damage) remain unchanged. From 2013 to 2018, the city had used several of the rooms on this level of the Auxiliary Building for storage.

Newly installed roof fabric continues to eliminate water seepage that was noted in past inspections in the Auxiliary Building along the ceiling seam of the Operating Air Pressure (OAP) Room and Room B-1, which is directly below the OAP Room. The southwest wall of both rooms is the curved wall of the Containment Building. The evidence of previous water seepage is noted on the 79 ft level site inspection map and will continue to be monitored in future inspections.

83-foot level: No issues identified.

100-foot level: The concrete around the southwest air lock of the Containment Building remains in need of repair. Numerous cracks are present, and some small pieces of concrete are falling off. LM is determining a path forward for the facility that will evaluate the repair of the concrete around the air lock (PL-4).

111-foot level: No concerns.

121-foot level (Auxiliary Building rooftop): The roof fabric of the Auxiliary Building was replaced in 2016 and remains in excellent condition. Auxiliary Building roof drains also were in excellent condition.

2.4 Cathodic Protection System

A cathodic protection system was installed on the Containment Building during construction of the facility to protect the 3/8 inch steel shell that surrounds the exterior of the below grade portion of the reactor shell. The system consists of 10 carbon (graphite) electrodes buried radially approximately 10 to 20 ft 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 air lock on the 100 ft level of the Auxiliary Building. 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 includes reference electrodes and test holes.

The cathodic protection system was checked by a qualified service provider in 2016, and all electrodes were replaced. The system is currently turned off because electric service to the facility was turned off in 2019. An assessment conducted by LM in 2018 recommended that the system be maintained until January 2041 (DOE 2018). LM is evaluating the continued need for the cathodic protection system, pending a decision concerning the long-term state of the facility.

2.5 High Water Alarm System

An alarm system is installed in the sump on the 56 ft level of the Containment Building to detect high water levels before they reach the bottom of the entombment. This system was designed to prevent immersion and accelerated corrosion of the entombment. The alarm would trigger when the sump pump filled to a level near overflow, alerting personnel to both high water and possible sump pump failure. The alarm would register in the Auxiliary Building on the Supervisory Control and Data Acquisition System, which was monitored 24 hours a day. The alarm system was included in the monthly building inspection that had historically been conducted by the City of Piqua.

In 2018, inspectors were informed that the high water alarm to the sump system was removed prior to 2013 when the city's power system personnel vacated the building. A 2018 assessment recommended that the high water alarm system be reinstalled (DOE 2018). LM is evaluating the

continued need for the high water alarm, pending a decision concerning the long-term state of the facility.

2.6 Radiological Survey

LMS contractor staff performed the annual radiological survey inside the Containment Building, the Auxiliary Building, and in exterior areas; 106 sample locations were checked for both removable and direct surface contamination using direct measurements and smears to detect alpha, beta, and gamma radiation activity. Gamma radiation exposure rates also were measured.

In 2009, the city modified Rooms R-6 and R-7. Modifications included the elimination of an air duct (a component of the heating, ventilation, and air-conditioning system) connecting the two rooms. Smear sample No. 46 was collected from this air duct before 2009. Survey location No. 46 is now on the floor of Room R-7 in front of the former air duct.

Table 1 presents information about the instrumentation used to perform the survey.

Table 1. Instrumentation for Radiological Survey

Type of Measurement	Radiation	Detector Serial Number	Meter Serial Number	Background	Efficiency Factor	Critical Value
Direct activity	Alpha	Ludlum 43-89 PR184184	Ludlum 2360 177157	2.0 cpm/ 100 cm²	17% efficient	29
Direct activity	Beta	Ludlum 43-89 PR184184	Ludlum 2360 177157	144 cpm/ 100 cm²	40% efficient	73
Exposure rate	Gamma	NA	Thermo FH40 GL 016191	5 µrem/h	NA	NA
Removable activity	Alpha	Ludlum 43-10-1 PR362456	Ludlum 2929 329909	0.4 cpm	32% efficient	3
Removable activity	Beta	Ludlum 43-10-1 PR362456	Ludlum 2929 329909	38.0 cpm	39% efficient	27

Abbreviations:
cm^2 = square centimeters
cpm = counts per minute
dpm = disintegrations per minute
µrem/h = microrem per hour
NA = not applicable or accessible

2.6.1 Survey Results for 2020

Direct measurements and smear surveys were collected at 106 locations in 2020, and results were consistent with past years. Survey locations are provided in Appendix A. Six survey locations had removable beta contamination above the critical value level but below the 10 CFR 835 surface contamination limit values. The highest removable surface contamination value was 51 dpm/100 cm^2, substantially below the 10 CFR 835 beta removable surface contamination limit value of 1000 dpm/100 cm^2. Specific results are provided in Appendix B.

The results of both the direct and smear surveys were all lower than 10 CFR 835 limits for surface contamination. Only one location (floor drain location No. 16 on the 56 ft level) had a direct reading above the critical value of 73 dpm/100 cm^2 for beta. That direct reading was

688 dpm/100 cm^2 for beta, which is well below the 10 CFR 835 limit of 5000 dpm/100 cm^2 for beta. The smear from this location indicated that no removable activity was present. All direct readings for alpha were less than the critical value of 29 dpm/100 cm^2. The 10 CFR 835 limit for alpha is 500 dpm/100 cm^2.

Gamma radiation exposure rates also were measured during the survey. Reading locations are provided in Appendix A. The highest gamma radiation exposure rate measured in the facility (100 ft level of the Auxiliary Building) in 2019 was 10 microrem per hour (µrem/h). This was 5 µrem/h above the outside background measurement of 5 µrem/h. The 5 µrem/h above background is significantly lower than the 10 CFR 835 limit for a radiation area of 5000 µrem/h.

3.0 Maintenance Action Requests

Maintenance activities are on hold pending a decision on the long-term state of the facility unless maintenance is needed ensure the immediate protectiveness of the entombment.

4.0 References

DOE (U.S. Department of Energy), 2017. *Decommissioned Reactor Site, Piqua, Ohio, Hazardous Materials Survey*, Resource International Incorporated, January.

DOE (U.S. Department of Energy), 2018. *Piqua, Ohio, Decommissioned Reactor Site Water Control System Assessment*, LMS/PIQ/S22314, U.S. Department of Energy, December 2018.

5.0 Photographs

Photograph Location Number	Azimuth	Elevation Level (in feet)	Photograph Description
PL-1	215	100	Containment Building
PL-2	170	100	New Paving to Water Treatment Plant
PL-3	30	100	New Retaining Wall
PL-4	360	100	Air Lock

PL-1. Containment Building

PL-2. New Paving to Water Treatment Plant

PL-3. New Retaining Wall

PL-4. Air Lock

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Appendix A

Site Drawings

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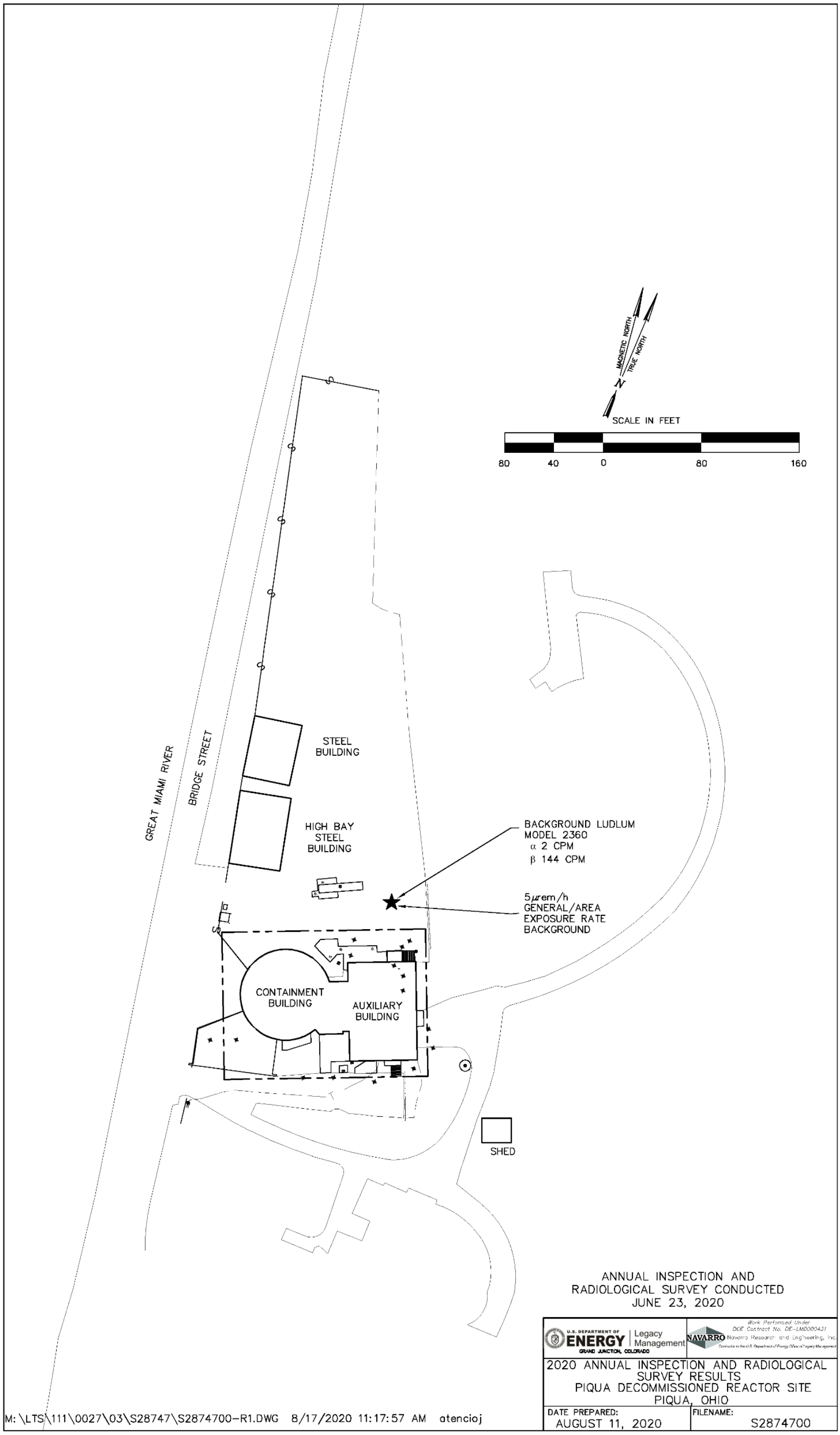
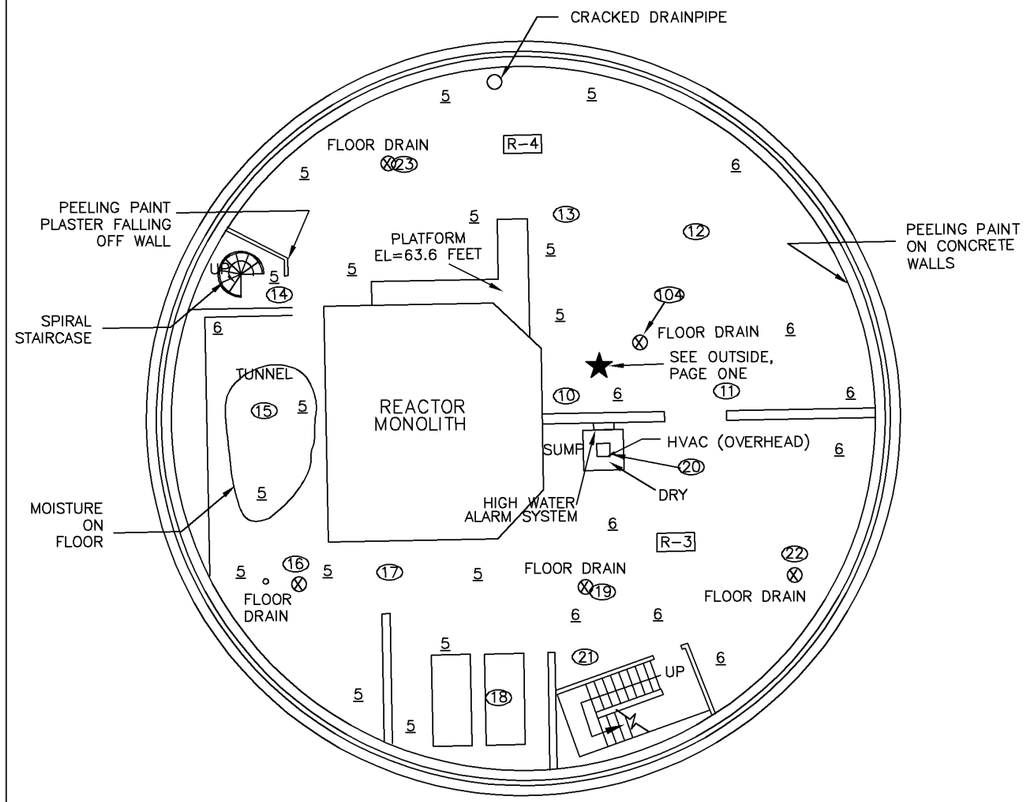


Figure A-1. 2019 Annual Inspection and Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site



PLAN – 56 FOOT LEVEL

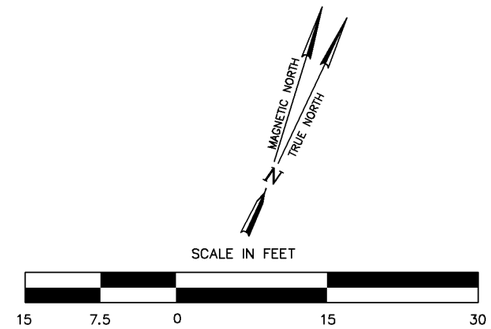
SMEAR/DIRECT LOCATIONS ON THE 56-FOOT LEVEL

(10)-FLOOR
(11)-FLOOR
(12)-FLOOR
(13)-FLOOR
(14)-FLOOR
(15)-FLOOR
(16)-IN FLOOR DRAIN
(17)-FLOOR
(18)-ON PEDESTAL
(19)-ON FLOOR DRAIN
(20)-SUMP GRATING
(21)-ON VENT BY STAIRWELL
(22)-ON FLOOR DRAIN
(23)-ON FLOOR DRAIN
(104)-ON FLOOR DRAIN

KEY:

NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R-4 = ROOM NUMBER

★ = BACKGROUND DETERMINATION LOCATION OUTSIDE
LUDLUM MODEL 2360 α = 2 cpm GAMMA BACKGROUND 5μrem/h
β = 144 cpm



ANNUAL INSPECTION AND
RADIOLOGICAL SURVEY CONDUCTED
JUNE 23, 2020

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under DOE Contract No. DE-LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO

DATE PREPARED: AUGUST 11, 2020
FILENAME: S2874700

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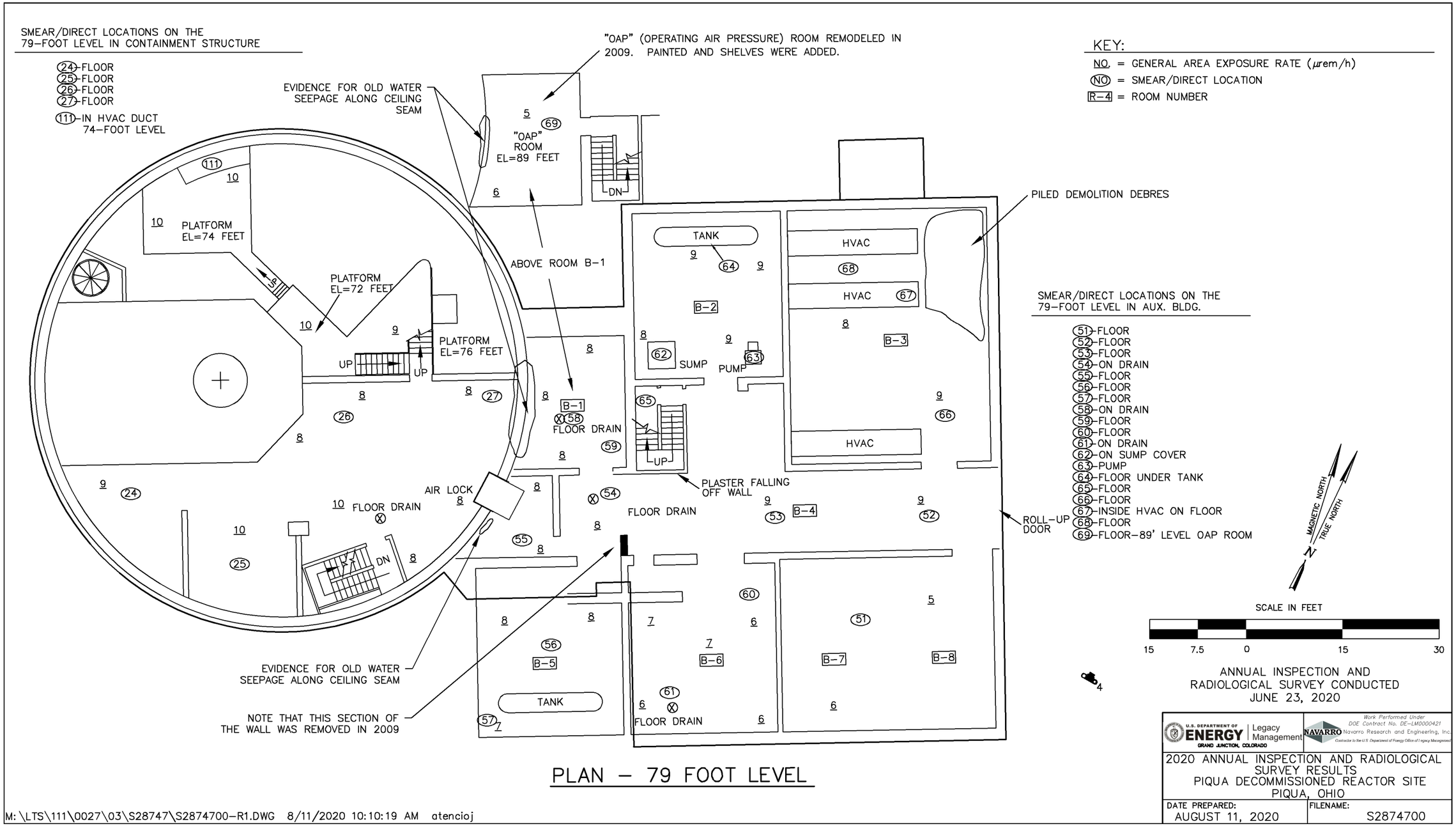
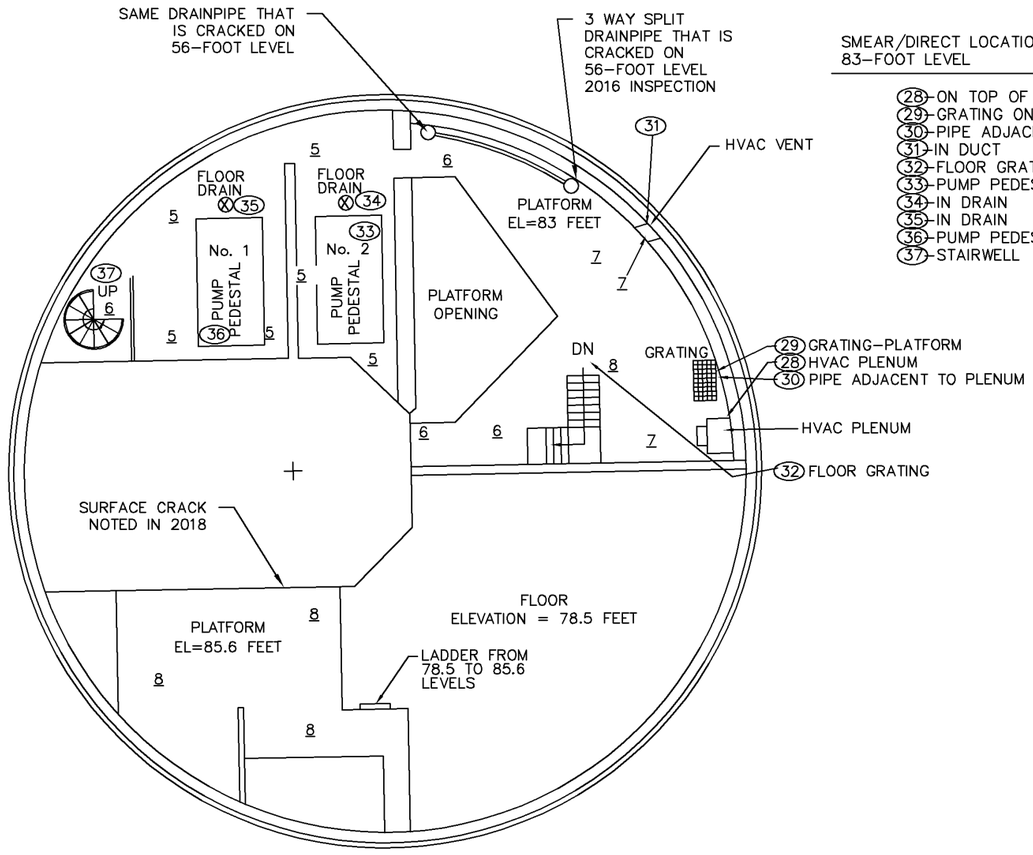
Figure A-2. Annual Radiological Survey Results Piqua, Ohio, Decommissioned Reactor Site Plan, 56-Foot Level



PLAN – 79 FOOT LEVEL

Figure A-3. Annual Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site Plan, 79-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-PIPE REMOVED
(31)-IN DUCT
(32)-FLOOR GRATING
(33)-PUMP PEDESTAL
(34)-IN DRAIN
(35)-IN DRAIN
(36)-PUMP PEDESTAL
(37)-STAIRWELL

(29) GRATING-PLATFORM
(28) HVAC PLENUM
(30) PIPE ADJACENT TO PLENUM
(32) FLOOR GRATING

KEY:

NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION

PLAN – 83 FOOT LEVEL

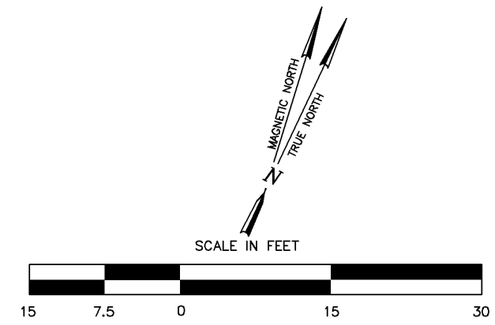


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Figure A-4. Annual Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site Plan, 83-Foot Level

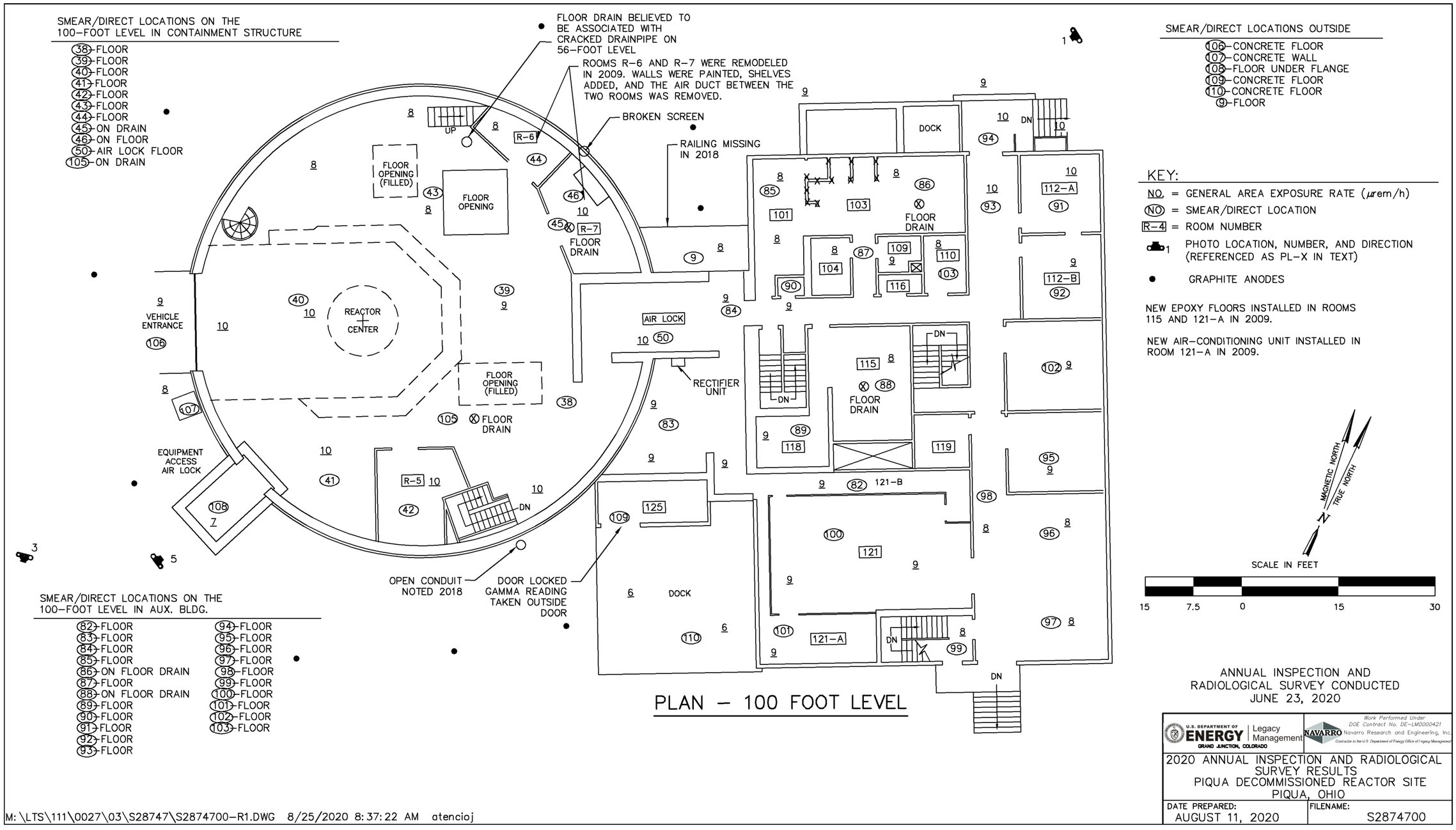


Figure A-5. Annual Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site Plan, 100-Foot Level

SMEAR/DIRECT LOCATIONS ON THE
111–FOOT LEVEL IN CONTAINMENT STRUCTURE

(47)–FLOOR
(48)–FLOOR
(49)–FLOOR

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

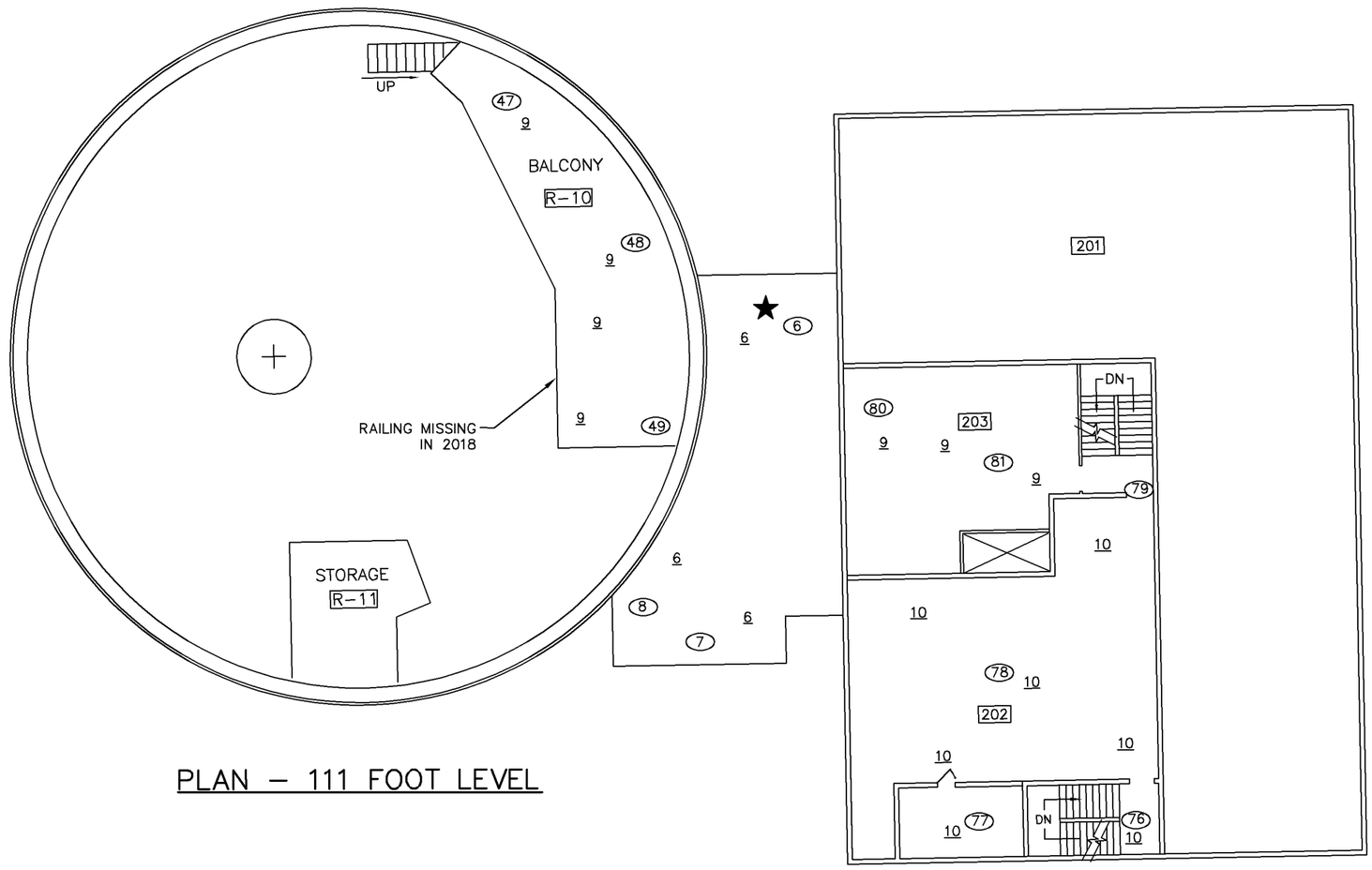
(76)–FLOOR
(77)–FLOOR
(78)–FLOOR
(79)–FLOOR
(80)–ON VENT DUCT
(81)–FLOOR

SMEAR/DIRECT LOCATIONS ON THE
OUTSIDE ON ROOF

★ (6)–ON CONCRETE PLATFORM
(7)–ON CONCRETE PLATFORM
(8)–ON CONCRETE PLATFORM

KEY:

NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R–4 = ROOM NUMBER



PLAN – 111 FOOT LEVEL

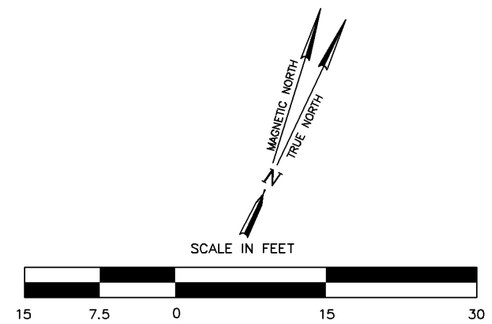


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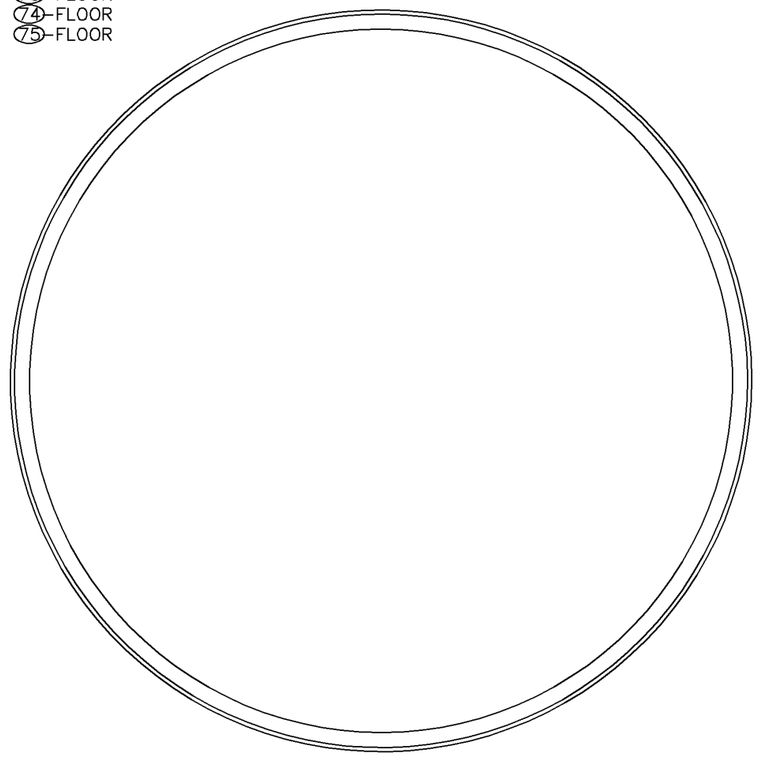
Figure A-6. Annual Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site Plan, 111-Foot Level

SMEAR/DIRECT LOCATIONS ON THE
121–FOOT LEVEL IN THE AUX. BLDG.

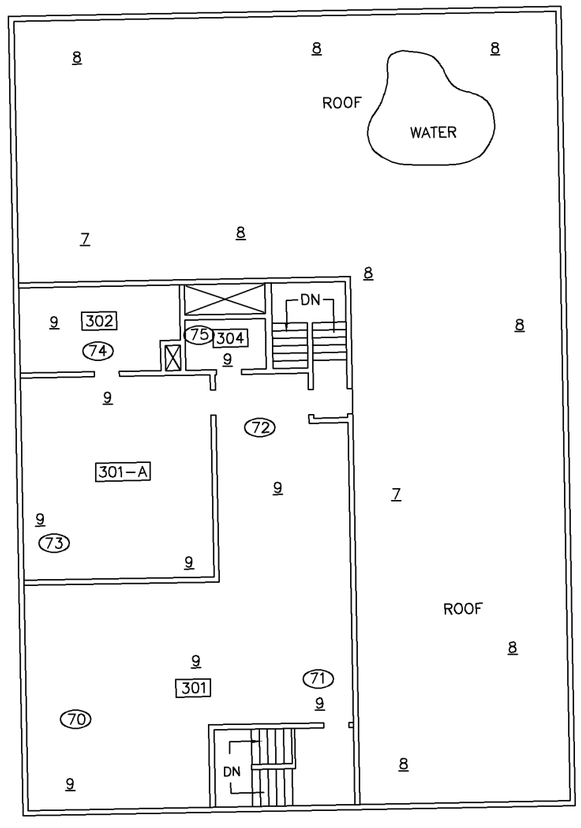
(70)–FLOOR
(71)–FLOOR
(72)–FLOOR
(73)–FLOOR
(74)–FLOOR
(75)–FLOOR

KEY:

NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R–4 = ROOM NUMBER



PLAN – 121 FOOT LEVEL



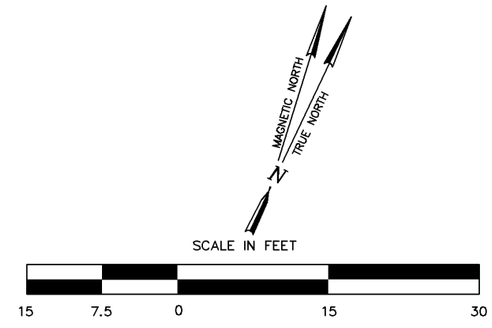


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Figure A-7. Annual Radiological Survey Results, Piqua, Ohio, Decommissioned Reactor Site Plan, 121-Foot Level

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Appendix B

2020 Piqua Annual Radiological Survey Results

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NAVARRO

Contractor to the U.S. Department of Energy, Office of Legacy Management

Radiological Survey Map

Radiological Survey Number: 200623-001 **Page** 1 **of** 14

Purpose: 2020 Annual Piqua Radiological Survey Truck #: N/A Trailer #: N/A

RWP number: N/A Time: 3:00 PM Date: 6/23/2020

Site name: Piqua Location: Various

RCT (printed): L. Oeffner Jr. Reviewer signature: SCOTT NEWSOM (Affiliate) Digitally signed by SCOTT NEWSOM (Affiliate) Date: 2020.08.13 15:47:11 -06'00' Date:

Counting Instruments:	Instrument 1	Instrument 2	Instrument 3	Radiation Instruments:	Instrument 4
Instrument/probe model:	Lud-2929/43-10-1		Lud-2360/43-89	Instrument/probe model:	Thermo FH40G-L
Instrument serial number:	329909		177157	Instrument serial number:	16191
Probe serial number:	PR362456		PR184184	Probe serial number:	N/A
Calibration due:	5/27/2021		5/27/2021	Calibration due:	5/27/2021
Efficiency:	α 0.32 β 0.39	α β	α 0.17 β 0.40	Background (dose rate):	5 microRem/hr
Background (cpm):	α 0.40 β 38	α β	α 2 β 144	Other info (as needed):	none
S_C (dpm/100cm^2):	α 3 β 27	α β	α 29 β 73		
Area probe correction factor:	1.0		1.0		

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm^2	Beta/gamma dpm/100cm^2	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm^2	Beta/gamma dpm/100cm^2	
1, N/A														
2, N/A														
3, N/A														
4, N/A														
5, N/A														
6. N/A														
7, N/A														
8, N/A														
9, floor	1	0	39	-0.4	1.0	< Sc	< Sc							
10, floor	1	0	40	-0.4	2.0	< Sc	< Sc							
11, floor	1	0	36	-0.4	-2.0	< Sc	< Sc							
12, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
13, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
14, floor	1	1	36	0.6	-2.0	< Sc	< Sc							
15, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
16, drain	1	0	40	-0.4	2.0	< Sc	< Sc	3	419	1.0	275.0	< Sc	688	

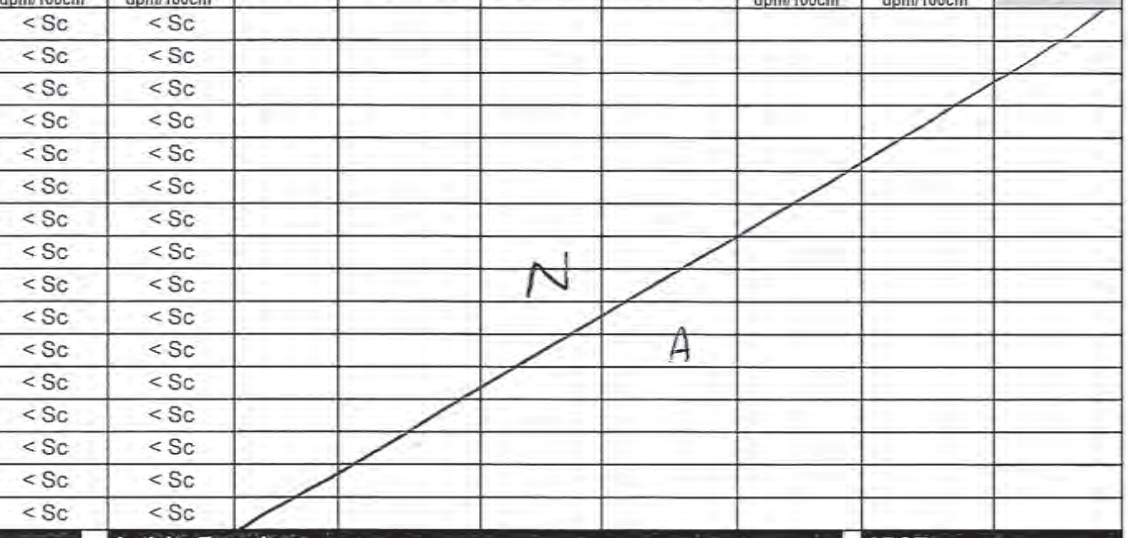
RCT signature: LAWRENCE OEFFNER (Affiliate) Digitally signed by LAWRENCE OEFFNER (Affiliate) Date: 2020.08.12 14:47:54 -04'00' File index number:

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 2 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm^2	Beta/gamma dpm/100cm^2	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm^2	Beta/gamma dpm/100cm^2	
17, floor	1	0	41	-0.4	3.0	< Sc	< Sc							
18, pedestal	1	0	47	-0.4	9.0	< Sc	< Sc							
19, drain	1	0	36	-0.4	-2.0	< Sc	< Sc							
20, grating	1	0	37	-0.4	-1.0	< Sc	< Sc							
21, vent	1	0	33	-0.4	-5.0	< Sc	< Sc							
22, drain	1	0	38	-0.4	0.0	< Sc	< Sc							
23, drain	1	0	40	-0.4	2.0	< Sc	< Sc							
24, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
25, floor	1	0	47	-0.4	9.0	< Sc	< Sc							
26, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
27, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
28,HVAC duct	1	1	34	0.6	-4.0	< Sc	< Sc							
29, grating	1	0	48	-0.4	10.0	< Sc	< Sc							
30, pipe	1	0	41	-0.4	3.0	< Sc	< Sc							
31, duct	1	0	42	-0.4	4.0	< Sc	< Sc							
32, grating	1	0	33	-0.4	-5.0	< Sc	< Sc							



Applicable Surface Contamination Limits

Check one for alpha, 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/100cm^2

APCE

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks:

HVAC equipment removed at locations 1-5, standing water from rain on roof, at locations 6-8, therefore no smears or direct readings taken. *No direct, static measurements taken, as there were no obvious increase in audible count rates, except location #16.

NAVARRO

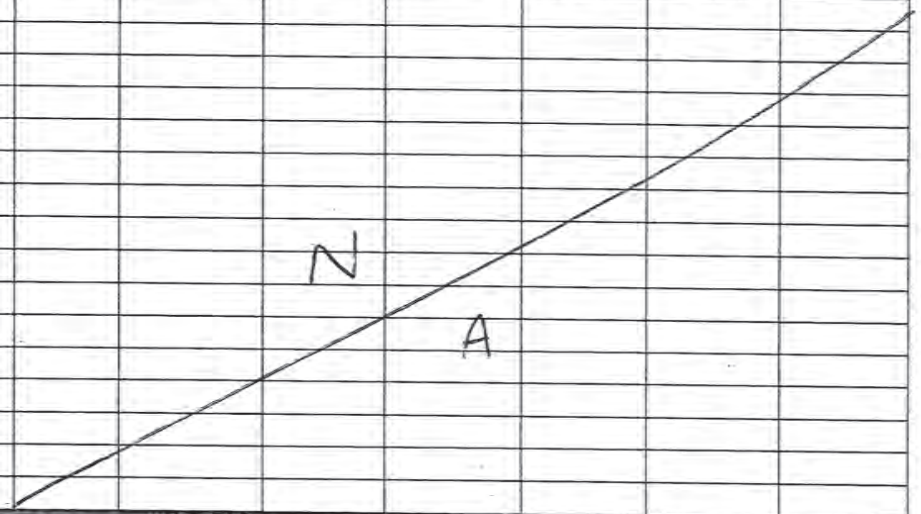
Contractor to the U.S. Department of Energy Office of Legacy Management

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 3 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	
33, pedestal	1	1	45	0.6	7.0	< Sc	< Sc							
34, drain	1	0	36	-0.4	-2.0	< Sc	< Sc							
35, drain	1	1	37	0.6	-1.0	< Sc	< Sc							
36, pedestal	1	1	46	0.6	8.0	< Sc	< Sc							
37, stairwell	1	0	49	-0.4	11.0	< Sc	28							
38, floor	1	0	34	-0.4	-4.0	< Sc	< Sc							
39, floor	1	1	41	0.6	3.0	< Sc	< Sc							
40, floor	1	0	39	-0.4	1.0	< Sc	< Sc							
41, floor	1	0	32	-0.4	-6.0	< Sc	< Sc							
42, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
43, floor	1	0	39	-0.4	1.0	< Sc	< Sc							
44, floor	1	0	41	-0.4	3.0	< Sc	< Sc							
45, drain	1	1	41	0.6	3.0	< Sc	< Sc							
46, floor	1	0	40	-0.4	2.0	< Sc	< Sc							
47, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
48, floor	1	0	41	-0.4	3.0	< Sc	< Sc							



Applicable Surface Contamination Limits

Check one for alpha, 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/100cm²

APCE

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks:

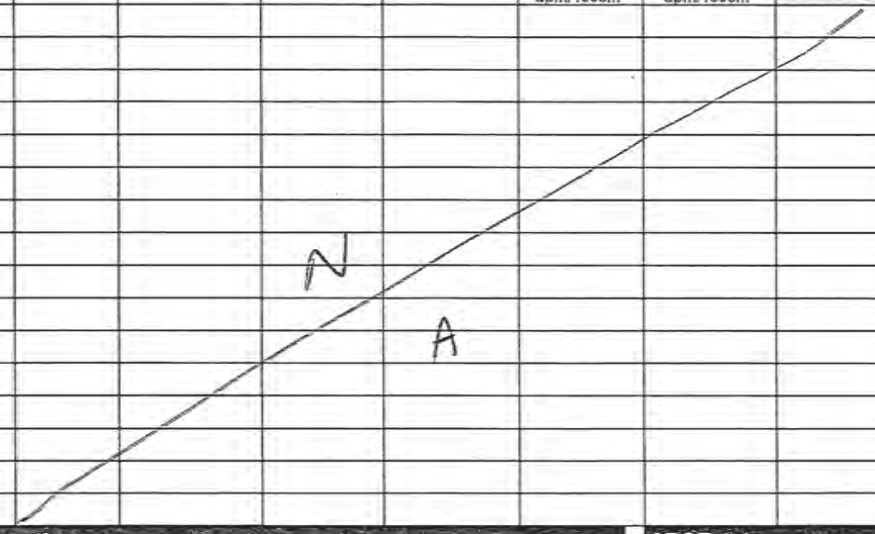
* No direct, static measurements taken, as there were no obvious increase in audible count rates.

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 4 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	
49, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
50, airlock	1	0	44	-0.4	6.0	< Sc	< Sc							
51, floor	1	0	45	-0.4	7.0	< Sc	< Sc							
52, floor	1	0	58	-0.4	20.0	< Sc	51							
53, floor	1	0	45	-0.4	7.0	< Sc	< Sc							
54, drain	1	0	41	-0.4	3.0	< Sc	< Sc							
55, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
56, floor	1	0	39	-0.4	1.0	< Sc	< Sc							
57, floor	1	1	39	0.6	1.0	< Sc	< Sc							
58, drain	1	0	48	-0.4	10.0	< Sc	< Sc							
59, floor	1	0	36	-0.4	-2.0	< Sc	< Sc							
60, floor	1	0	43	-0.4	5.0	< Sc	< Sc							
61, drain	1	0	43	-0.4	5.0	< Sc	< Sc							
62,sump cover	1	1	36	0.6	-2.0	< Sc	< Sc							
63, pump	1	0	49	-0.4	11.0	< Sc	28							
64, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							



Applicable Surface Contamination Limits

Check one for alpha, 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/100cm²

APCE

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks:

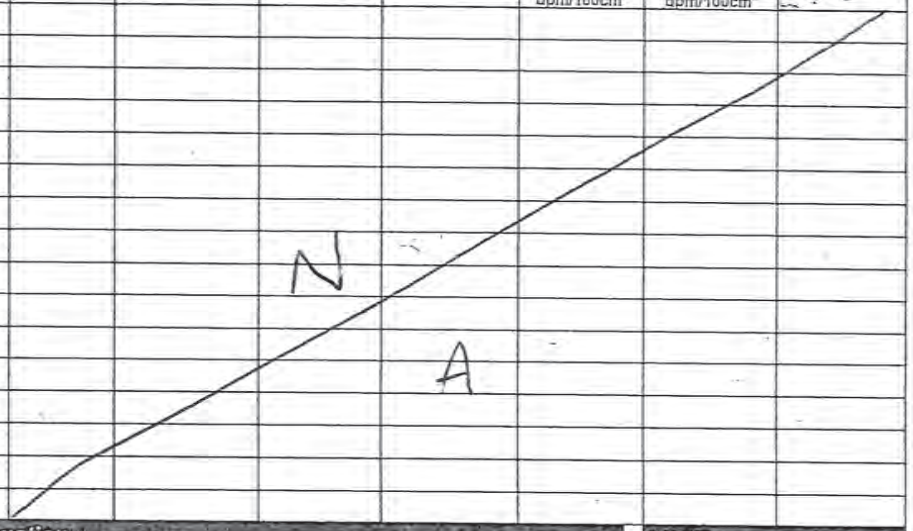
*No direct, static measurements taken, as there were no obvious increase in audible count rates.

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 5 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	
65; floor	1	1	38	0.6	0.0	< Sc	< Sc							
66, floor	1	0	36	-0.4	-2.0	< Sc	< Sc							
67, HVAC floor	1	0	40	-0.4	2.0	< Sc	< Sc							
68, floor	1	0	41	-0.4	3.0	< Sc	< Sc							
69, floor	1	0	38	-0.4	0.0	< Sc	< Sc							
70, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
71, floor	1	0	38	-0.4	0.0	< Sc	< Sc							
72, floor	1	0	41	-0.4	3.0	< Sc	< Sc							
73, floor	1	0	40	-0.4	2.0	< Sc	< Sc							
74, floor	1	0	45	-0.4	7.0	< Sc	< Sc							
75, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
76, floor	1	1	47	0.6	9.0	< Sc	< Sc							
77, floor	1	0	36	-0.4	-2.0	< Sc	< Sc							
78, floor	1	0	50	-0.4	12.0	< Sc	31							
79, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
80, vent duct	1	0	40	-0.4	2.0	< Sc	< Sc							



Applicable Surface Contamination Limits

Check one for alpha, 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/100cm²

APCE

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks:

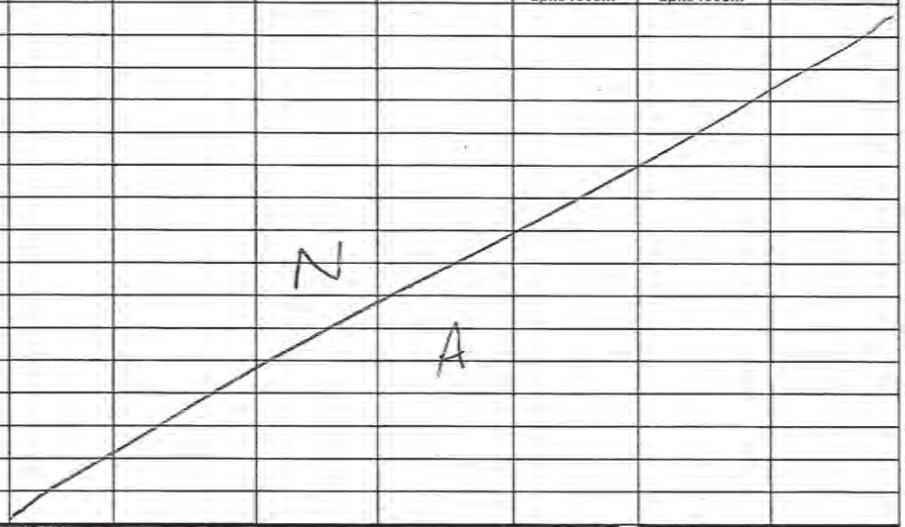
*No direct, static measurements taken, as there were no obvious increase in audible count rates.

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 6 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	
81, floor	1	1	49	0.6	11.0	< Sc	28							
82, floor	1	0	32	-0.4	-6.0	< Sc	< Sc							
83, floor	1	0	29	-0.4	-9.0	< Sc	< Sc							
84, floor	1	0	28	-0.4	-10.0	< Sc	< Sc							
85, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
86, drain	1	0	36	-0.4	-2.0	< Sc	< Sc							
87, floor	1	0	40	-0.4	2.0	< Sc	< Sc							
88, drain	1	0	31	-0.4	-7.0	< Sc	< Sc							
89, floor	1	0	45	-0.4	7.0	< Sc	< Sc							
90, floor	1	0	38	-0.4	0.0	< Sc	< Sc							
91, floor	1	0	34	-0.4	-4.0	< Sc	< Sc							
92, floor	1	0	45	-0.4	7.0	< Sc	< Sc							
93, floor	1	0	44	-0.4	6.0	< Sc	< Sc							
94, floor	1	0	43	-0.4	5.0	< Sc	< Sc							
95, floor	1	0	39	-0.4	1.0	< Sc	< Sc							
96, floor	1	0	41	-0.4	3.0	< Sc	< Sc							



Applicable Surface Contamination Limits

Check one for alpha, 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

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APCE

44-9 = 6.5

FHZ 732 (GM) = 6.5

43-10-1 = 1

Remarks:

*No direct, static measurements taken, as there were no obvious increase in audible count rates.

NAVARRO

Contractor to the U.S. Department of Energy Office of Legacy Management

Radiological Survey Map

Radiological Survey Number: 200623-001 Page 7 of 14

Surface Contamination and Radiation Survey Results

Item Surveyed / Map Location	Counting Inst. No. Used	Smear Survey (Instrument 1 or 2)						Direct Survey (Instrument 3)						Exposure Rate Survey
		Gross Counts		Net Counts		Activity		Gross Counts		Net Counts		Activity		
		Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	Alpha cpm	Beta/gamma cpm	Alpha cpm	Beta/gamma cpm	Alpha dpm/100cm²	Beta/gamma dpm/100cm²	
97, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
98, floor	1	0	49	-0.4	11.0	< Sc	28							
99, floor	1	0	44	-0.4	6.0	< Sc	< Sc							
100, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
101, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
102, floor	1	0	38	-0.4	0.0	< Sc	< Sc							
103, floor	1	0	35	-0.4	-3.0	< Sc	< Sc							
104, drain	1	0	42	-0.4	4.0	< Sc	< Sc							
105, drain	1	0	39	-0.4	1.0	< Sc	< Sc							
106, floor	1	0	33	-0.4	-5.0	< Sc	< Sc							
107, wall	1	0	37	-0.4	-1.0	< Sc	< Sc							
108, floor	1	0	43	-0.4	5.0	< Sc	< Sc							
109, floor	1	0	37	-0.4	-1.0	< Sc	< Sc							
110, floor	1	0	44	-0.4	6.0	< Sc	< Sc							
111, duct	1	0	35	-0.4	-3.0	< Sc	< Sc							
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A							

N/A

Applicable Surface Contamination Limits

Check one for alpha, 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

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Dpm x Area Probe Correction Factor (APCF) = dpm/100cm²

APCE

44-9 = 6.5

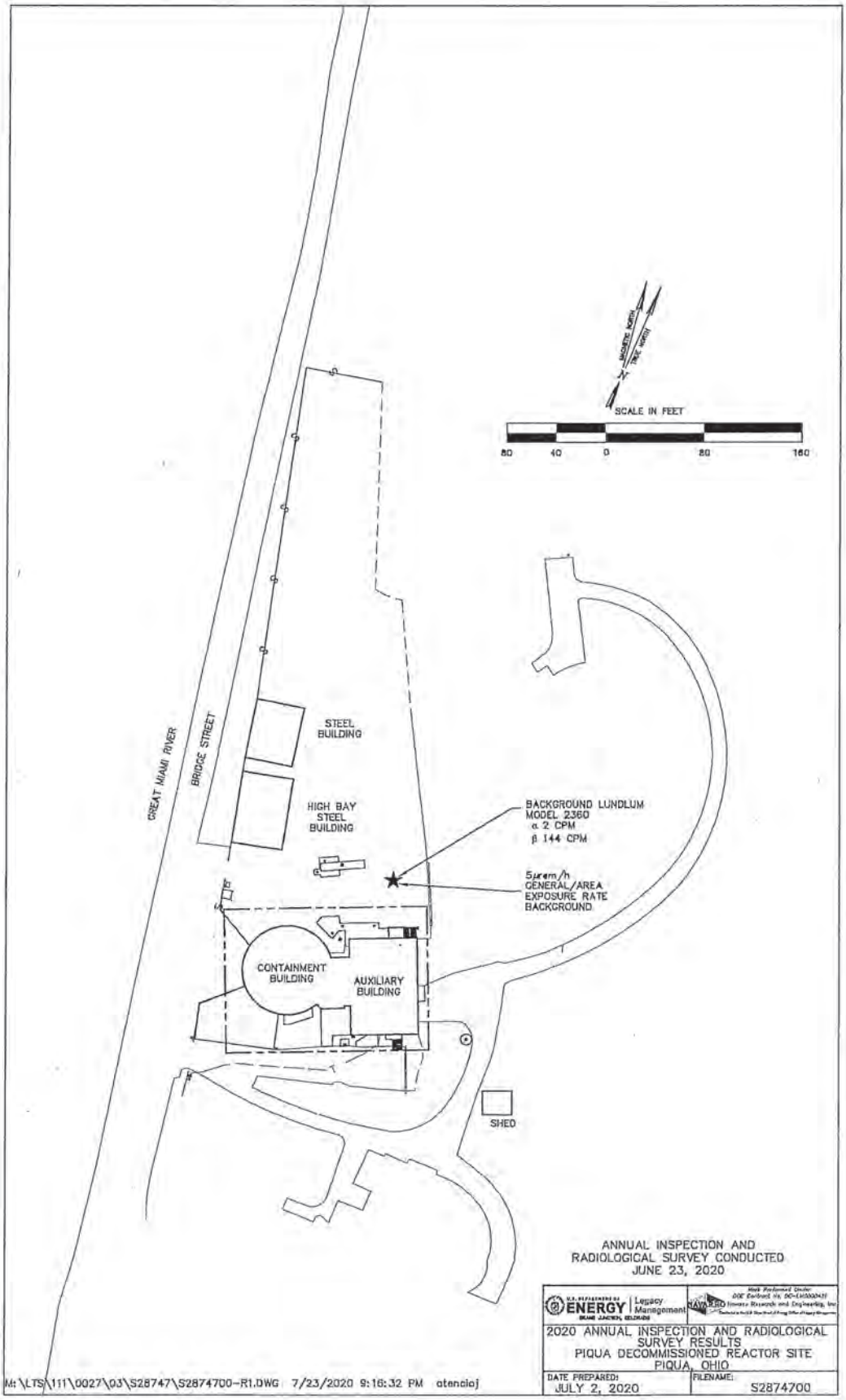
FHZ 732 (GM) = 6.5

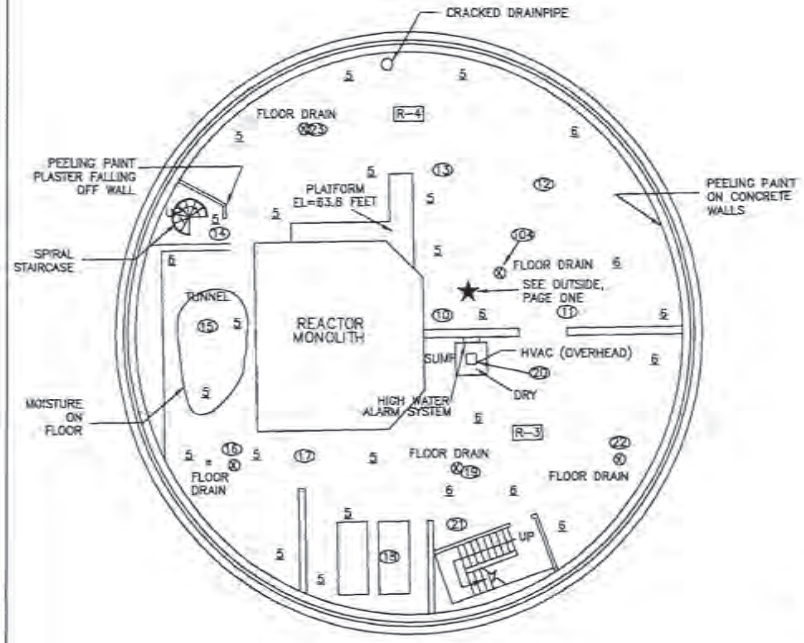
43-10-1 = 1

Remarks:

*No direct, static measurements taken, as there were no obvious increase in audible count rates.

8 of 14
200623-001





PLAN – 56 FOOT LEVEL

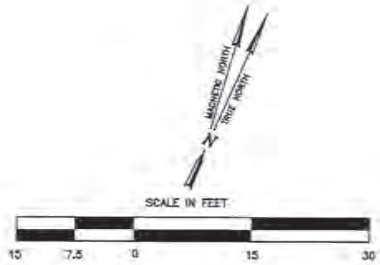
SMEAR/DIRECT LOCATIONS ON THE 56-FOOT LEVEL

- (10)-FLOOR
- (11)-FLOOR
- (12)-FLOOR
- (13)-FLOOR
- (14)-FLOOR
- (15)-FLOOR
- (16)-IN FLOOR DRAIN
- (17)-FLOOR
- (18)-ON PEDESTAL
- (19)-ON FLOOR DRAIN
- (20)-SUMP GRATING
- (21)-ON VENT BY STAIRWELL
- (22)-ON FLOOR DRAIN
- (23)-ON FLOOR DRAIN
- (104)-ON FLOOR DRAIN

KEY:

NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R-4 = ROOM NUMBER

★ = BACKGROUND DETERMINATION LOCATION OUTSIDE
LUNDLUM MODEL 2360 α = 2 cpm GAMMA BACKGROUND 5μrem/h
β = 144 cpm



ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED JUNE 23, 2020

U.S. DEPARTMENT OF ENERGY Legacy Management	RAC/LRSO
2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS PIQUA DECOMMISSIONED REACTOR SITE PIQUA, OHIO	
DATE PREPARED: JUNE 29, 2020	FILENAME: S2874700

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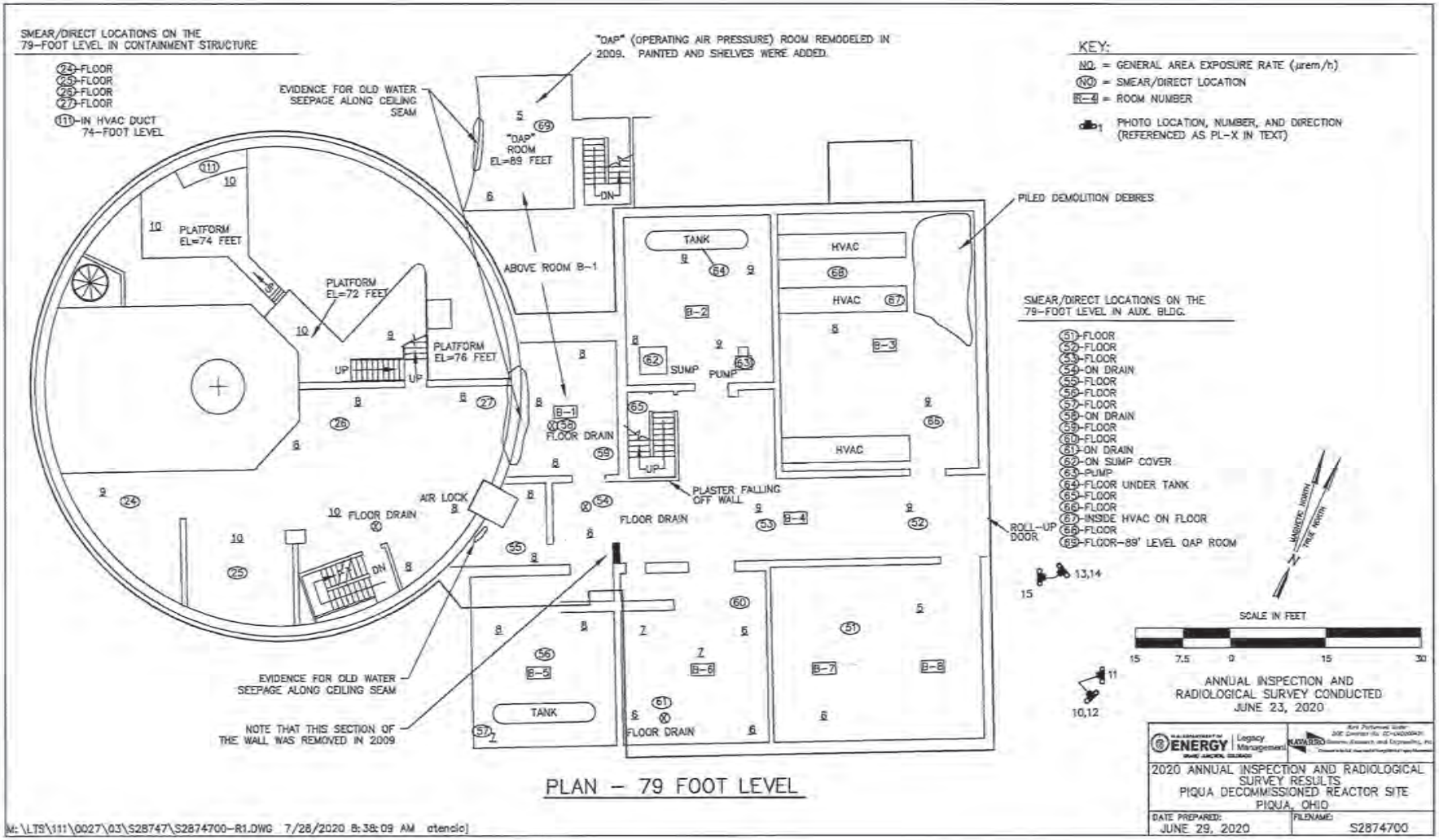
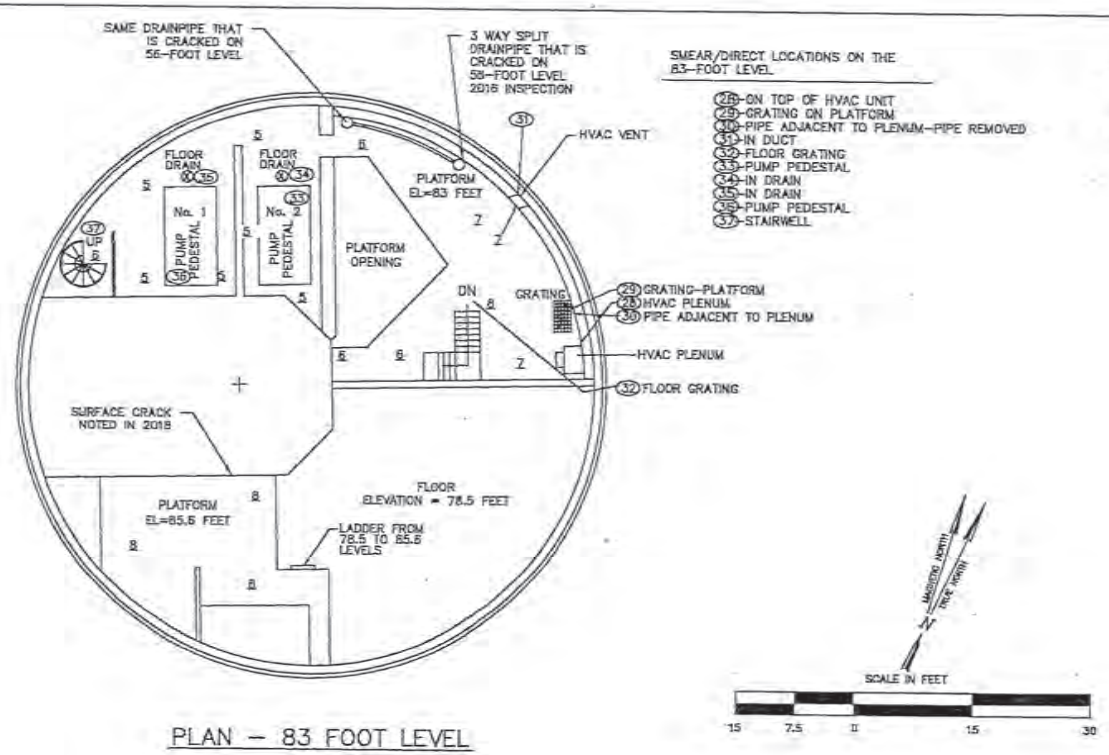


PLAN – 79 FOOT LEVEL



PLAN – 83 FOOT LEVEL

ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED JUNE 23, 2020

2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS PIQUA DECOMMISSIONED REACTOR SITE PIQUA, OHIO	
DATE PREPARED: JUNE 29, 2020	FILENAME: S2874700

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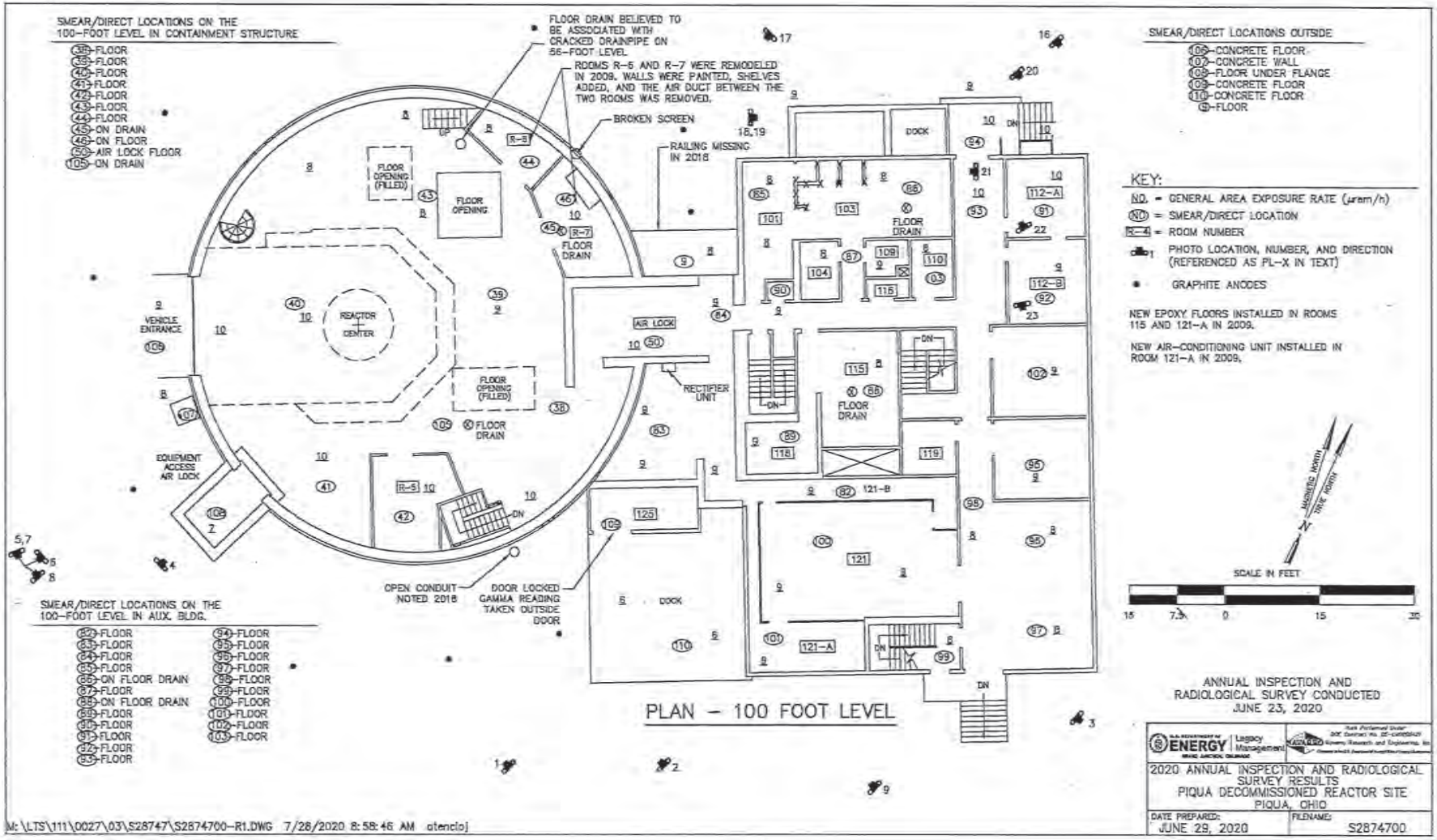
SMEAR/DIRECT LOCATIONS ON THE 100-FOOT LEVEL IN CONTAINMENT STRUCTURE
36-FLOOR
37-FLOOR
40-FLOOR
41-FLOOR
42-FLOOR
43-FLOOR
44-FLOOR
45-ON DRAIN
46-ON FLOOR
50-AIR LOCK FLOOR
105-ON DRAIN
FLOOR DRAIN BELIEVED TO BE ASSOCIATED WITH CRACKED DRAINPIPE ON 56-FOOT LEVEL
ROOMS R-6 AND R-7 WERE REMODELED IN 2009. WALLS WERE PAINTED, SHELVES ADDED, AND THE AIR DUCT BETWEEN THE TWO ROOMS WAS REMOVED.
BROKEN SCREEN
RAILING MISSING IN 2018
FLOOR OPENING (FILLED)
FLOOR OPENING
R-8
R-7
FLOOR DRAIN
VEHICLE ENTRANCE
REACTOR CENTER
AIR LOCK
RECTIFIER UNIT
EQUIPMENT ACCESS AIR LOCK
R-5
OPEN CONDUIT NOTED 2018
DOOR LOCKED GAMMA READING TAKEN OUTSIDE DOOR
DOCK
SMEAR/DIRECT LOCATIONS ON THE 100-FOOT LEVEL IN AUX. BLDG.
62-FLOOR
63-FLOOR
64-FLOOR
65-FLOOR
66-ON FLOOR DRAIN
67-FLOOR
68-ON FLOOR DRAIN
69-FLOOR
90-FLOOR
91-FLOOR
92-FLOOR
93-FLOOR
94-FLOOR
95-FLOOR
96-FLOOR
97-FLOOR
98-FLOOR
99-FLOOR
100-FLOOR
101-FLOOR
102-FLOOR
103-FLOOR
PLAN - 100 FOOT LEVEL
SMEAR/DIRECT LOCATIONS OUTSIDE
106-CONCRETE FLOOR
107-CONCRETE WALL
108-FLOOR UNDER FLANGE
109-CONCRETE FLOOR
110-CONCRETE FLOOR
S-FLOOR
KEY:
NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R-4 = ROOM NUMBER
PHOTO LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)
GRAPHITE ANODES
NEW EPOXY FLOORS INSTALLED IN ROOMS 115 AND 121-A IN 2009.
NEW AIR-CONDITIONING UNIT INSTALLED IN ROOM 121-A IN 2009.
MAGNETIC NORTH
TRUE NORTH
SCALE IN FEET
15 7.5 0 15 30
ANNUAL INSPECTION AND RADIOLOGICAL SURVEY CONDUCTED JUNE 23, 2020
ENERGY Legacy Management
2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO
DATE PREPARED: JUNE 29, 2020
FILENAME: S2874700
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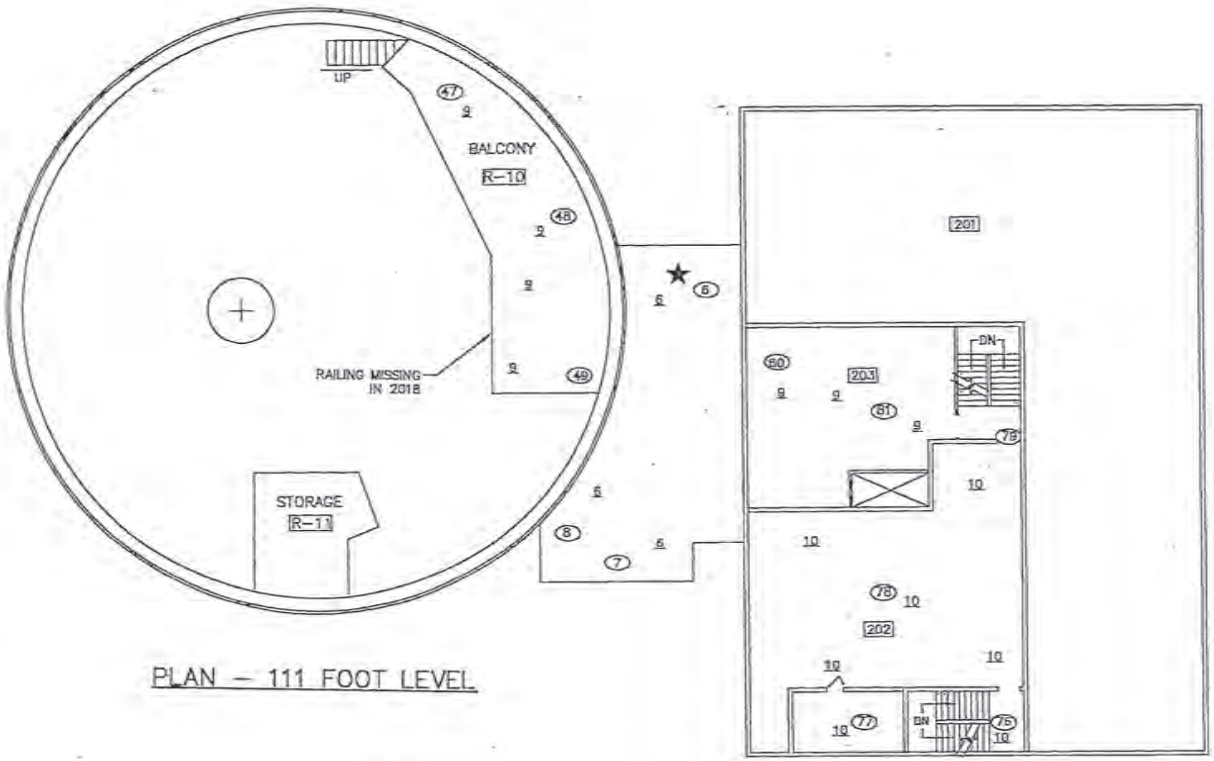
SMEAR/DIRECT LOCATIONS ON THE 111–FOOT LEVEL IN CONTAINMENT STRUCTURE
- (47)–FLOOR
- (48)–FLOOR
- (49)–FLOOR

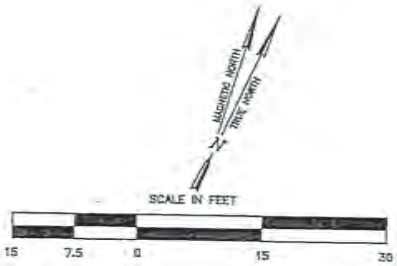
SMEAR/DIRECT LOCATIONS ON THE 111–FOOT LEVEL IN THE AUX. BLDG.
- (76)–FLOOR
- (77)–FLOOR
- (78)–FLOOR
- (79)–FLOOR
- (80)–ON VENT DUCT
- (81)–FLOOR

SMEAR/DIRECT LOCATIONS ON THE OUTSIDE ON ROOF
- ★ (6)–ON CONCRETE PLATFORM
- (7)–ON CONCRETE PLATFORM
- (8)–ON CONCRETE PLATFORM

KEY:
- NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
- (NO) = SMEAR/DIRECT LOCATION
- R–# = ROOM NUMBER
- PHOTO LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL–X IN TEXT)



PLAN – 111 FOOT LEVEL



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JUNE 23, 2020

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2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO

DATE PREPARED: JUNE 23, 2020
FILENAME: S2874700

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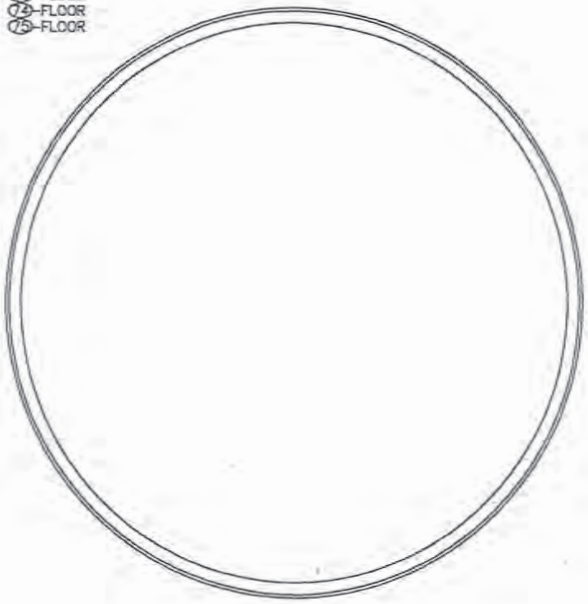
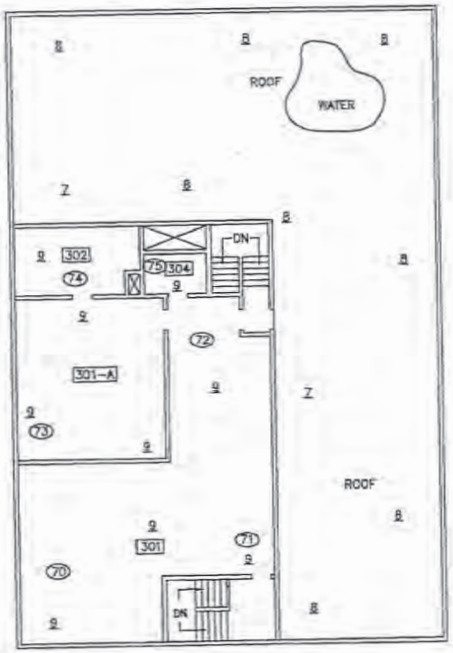
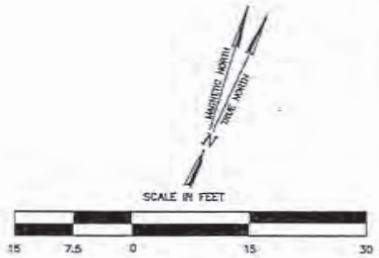
SMEAR/DIRECT LOCATIONS ON THE
121-FOOT LEVEL IN THE AUX. BLDG.
(70)-FLOOR
(71)-FLOOR
(72)-FLOOR
(73)-FLOOR
(74)-FLOOR
(75)-FLOOR



PLAN – 121 FOOT LEVEL

KEY:
NO. = GENERAL AREA EXPOSURE RATE (μrem/h)
(NO) = SMEAR/DIRECT LOCATION
R-# = ROOM NUMBER





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2020 ANNUAL INSPECTION AND RADIOLOGICAL SURVEY RESULTS
PIQUA DECOMMISSIONED REACTOR SITE
PIQUA, OHIO

DATE PREPARED: JUNE 29, 2020
FILENAME: S2874700

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