RSSI

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983800

RADIOLOGICAL MEASUREMENTS AT NBC TOWER 455 NORTH CITYFRONT PLAZA DRIVE CHICAGO, ILLINOIS

FOR:

ENVIRONMENTAL PROTECTION INDUSTRIES
16650 SOUTH CANAL
SOUTH HOLLAND, ILLINOIS 60473

ON:

JUNE 1, 2023

BY:

RSSI
6312 OAKTON STREET
MORTON GROVE, ILLINOIS 60053

JUNE 6, 2023

Introduction

On June 1, 2023, RSSI measured radiation levels from sub-surface sample as part of an underground storage tank removal at 455 North Cityfront Plaza Drive in Chicago, Illinois. The purpose of the measurements was to determine if elevated radiation levels associated with thorium contaminated soils were present.

Thorium-contaminated soils have been found at multiple locations in the Streeterville area of Chicago. Beginning in 1915, the Lindsay Light and Chemical Company (Lindsay Light) refined and used thorium in industrial operations. The Lindsay Light operation produced large volumes of thorium-contaminated tailings used as fill throughout Streeterville.

All isotopes of thorium are radioactive. Thorium's predominant isotopes are in the uranium and thorium decay series of naturally-occurring radioactive isotopes. These series begin with uranium-238 (U-238) and thorium-232 (Th-232), respectively, and decay through a progression of radionuclides to stable isotopes of lead. The radionuclides include intermediate progeny such as radium-226 (Ra-226) in the uranium series and Ra-228 and Ra-224 in the thorium series.

The EPA has set an action level in soil of 5 picocuries per gram (pCi/g) total radium (Ra-226+Ra-228) above a background concentration of 2.1 pCi/g for an action level of 7.1 pCi/g total radium. The EPA guidelines permit release of areas for unrestricted use when the concentration of total radium in soil does not exceed the action level.

Methodology

RSSI measured radiation levels using a Ludlum Model 193 survey meter with a side-shielded Ludlum Model 44-10 gamma scintillation detector. The Ludlum Model 193 is a general-purpose portable survey instrument with a fixed-point alarm and a quick deviation alarm that is based on the rate of change in radiation levels. The quick deviation alarm enables detection of slight changes in radiation levels. The Ludlum Model 44-10 has a 2"×2" thallium-doped sodium iodide (NaI(Tl)) gamma scintillator that responds to photons. The shielded detector restricts the angular response to radiation to in front of the scintillator crystal.

The instrument response was 680 counts per minute (cpm) per pCi/g of total radium when calibrated against a thorium source block. The EPA's action level of 7.1 pCi/g total radium corresponds to 4828 cpm above the instrument background (net cpm).

Results

Borehole samples from eight sites, situated around a parking garage entrance on the north side of North Lower Water Street, were surveyed for radioactive contamination upon removal from a geoprobe.

All radiation levels were below the action level. The highest measurements of around 600 net cpm, were seen found in two locations: the first material extracted from the generator room borehole which spilled onto the floor and the subsurface measurement inside a borehole in the parking garage exit lane. 600 net cpm corresponds to around 0.9 pCi/g total radium.

In general, each borehole was drilled through a concrete slab and then a geoprobe sampler was pressed into the now exposed soil and pulled back up to capture cores up to eight feet deep. Other than the sampled materials removed from the site for non-radiological environmental analysis, all material was pushed back into the boreholes before they were sealed with concrete.

Results are in Appendix A and measurement locations are in Appendix B. Instrument calibration records are in Appendix C.

Conclusions

No measurements exceeded the action level of 7.1 pCi/g total radium. No further action is required at this time.

Appendix A: Full Results

Table 1: Daily Instrumentation Configuration

Date	Meter SN	Background [cpm]	Action Level [gross cpm]	Efficiency[1]
6/1/2023	149080	1800	6628	680

All measurements taken with a 3-foot cable and a side-shielded probe.

Table Notes:
[1] Efficiency measured in net cpm per pCi/g total radium based on thorium block calibration.

Table 2: Results

Location	Depth[1]	[Gross cpm]	[net cpm]	Total Radium Concentration [pCi/g]
Generator room	OH	2000	200	0.3
Generator room, 1	Spill	2400	600	0.9
Generator room, 2	Tube	1600	0	0
Generator room, 3	Tube	1600	0	0
West sidewalk	OH	2000	200	0.3
West sidewalk, 1	Tube	2000	200	0.3
West sidewalk, 1b (additional drilling required for this depth)	Tube	2200	400	0.6
West sidewalk, 2	Tube	1800	0	0
West sidewalk, 3	Tube	1800	0	0
Mid apron	OH	1400	0	0
Mid apron, 1	Tube	2000	200	0.3
Mid apron, 2	Tube	2200	400	0.6
East exit lane hole 1	OH	2000	200	0.3
East exit lane hole 1, 1	Tube	2000	200	0.3
East exit lane hole 1, 2	Tube	1600	0	0
East exit lane hole 2	OH	2200	400	0.6
East exit lane hole 2	SS	2400	600	0.9
East exit lane hole 2, 1	Tube	1600	0	0
East exit lane hole 2, 2	Tube	1800	0	0
East exit lane hole 2, 3	Tube	2000	200	0.3
West inner (north) exit lane	OH	2000	200	0.3
West inner (north) exit lane	SS	2200	400	0.6
West inner (north) exit lane, 1	Tube	2000	200	0.3
West inner (north) exit lane, 2	Tube	1600	0	

Location	Depth[1]	[Gross cpm]	[net cpm]	Total Radium Concentration [pCi/g]
West inner (north) exit lane, 3	Tube	2000	200	0.3
West outer (south) exit lane	OH	2200	400	0.6
West outer (south) exit lane	SS	2200	400	0.6
West outer (south) exit lane, 1	Tube	1800	0	0
West outer (south) exit lane, 2	Tube	2000	200	0.3
West outer (south) exit lane, 3	Tube	1800	0	0
East apron	OH	1800	0	0
East apron, 1	Tube	1800	0	0
East apron, 2	Tube	2000	200	0.3
East apron, 3	Tube	2000	200	0.3

Table Notes:

[1] "OH" means over hole. The hole drilled through the concrete slab was smaller than the probe.

"SS" means sub-slab. A larger drill was used to remove a concrete slug from the slab allowing the probe to be placed against soil. Samples were still removed by the same geoprobe.

"Spill" means that the sampled material did not stay within the geoprobe plastic liner and instead spilled out.

"Tube" means the sample was surveyed from outside the plastic liner of the geoprobe sampler. Samples are shown in order of increasing depth (e.g. sample 1 is taken closer to the surface than sample 3).

Appendix B: Diagrams and Site Photos

Figure 1: Site Diagram

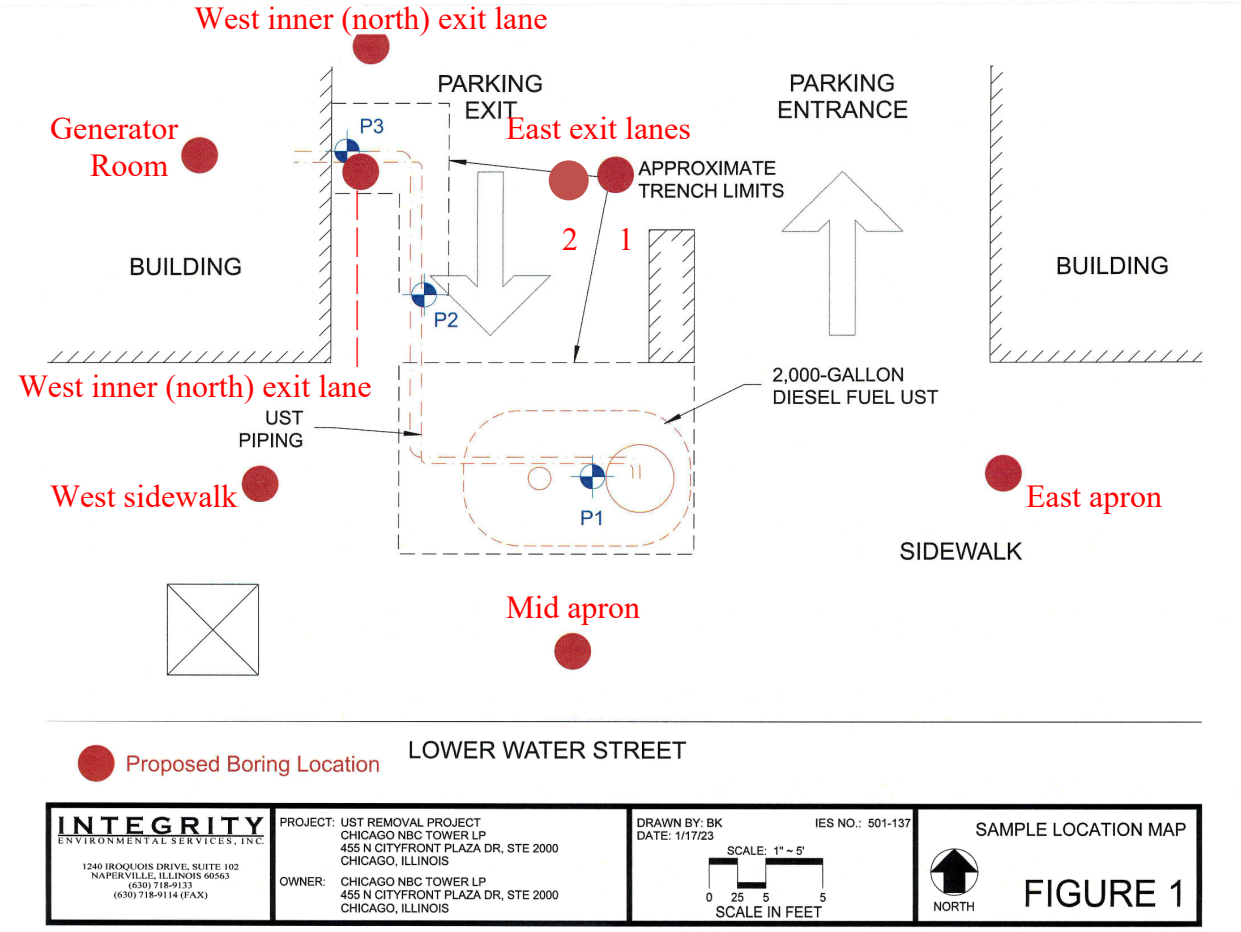

Figure 2: Generator room borehole (north to lower left)

Figure 3: West sidewalk borehole (north to left)

Figure 4: Mid apron borehole (north to left)

Figure 5: Exit lane boreholes (north to top)

Key:
1 - East exit lane hole 1
2 - East exit lane hole 2
3 - West inner (north) exit lane
4 - West outer (south) exit lane

Figure 6: East apron borehole (under middle cone) (north to left)

Appendix C: Calibration Records

RSSI

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CERTIFICATE OF CALIBRATION

Certificate No. 054813

RSSI
Attention: Eli A. Port
6312 Oakton Street
Morton Grove, IL 60053-2723

Manufacturer: LUDLUM
Model: 193
Serial No.: 149080
Probe(s): LUDLUM 44-10, Sn: PR155592 (#2)

CALIBRATION DATA

SOURCE*	SCALE	FIELD (cpm)	READING (cpm)	FIELD (cpm)	READING (cpm)
5	x1	200	200	800	800
5	x10	2 K	2 K	8 K	8 K
5	x100	20 K	20 K	80 K	80 K
5	x1000	200 K	200 K	800 K	800 K

If the accuracy of a scale is not within +/-10% but is within +/-20% a correction factor is supplied.

LUDLUM 44-10 γ Efficiencies in cpm per pCi/g:

	Thorium		Radium	
	Shielded	**Unshielded**	**Shielded**	**Unshielded**
3' Cable	680	1,760	680	1,960
25" Cable	282	356	282	366

LUDLUM 44-10 US EPA Action Level of 7.1 pCi/g in net cpm:

	Thorium		Radium	
	Shielded	**Unshielded**	**Shielded**	**Unshielded**
3' Cable	4,828	12,496	4,828	13,916
25" Cable	2,002	2,528	2,002	2,599

Check Source: Ba-133 **Reading:** 240 kcpm **Cable Length:** 3'
Check Source: Ba-133 **Reading:** 43 kcpm **Cable Length:** 25'

Comments: Check source readings taken with label side facing detector.

Calibrated by: Aaron D. Morris _____ **Date**: 05/08/23

Calibration Frequency: Annual **Recalibrate by**: 05/08/24

***SOURCE**	**1. Cs-137**	**2. Cs-137**	**5. Electronic**	**6. Other**
Manufacturer	U.S. Nuclear	Eon Corp.	LUDLUM	
Model	CCs-D-20E	64-764	500	
Serial Number	69036EZ	222	32789	
Activity	15 Ci	100 mCi	NONE	
Date	4/23/2009	5/2/1978	8/24/2021	

Calibration authorized by Illinois Department of Nuclear Safety License No. IL-01429-01 and meets the requirements of ANSI 323-1978 and MIL-STD-45662A. Exposure rate traceable to NIST with MDH model 1015 SN 2772 transfer instrument. Radcal Certificate of Conformance S130720. NRC-CNRC Exposure Calibration Report IRS-2023-3723.

PREVENTIVE MAINTENANCE PERFORMED

BATTERIES/CONTACTS CHECKED	✓	1.51, 1.50 V
HIGH VOLTAGE MEASURED	✓	882 VOLTS
SENSITIVITY MEASURED	✓	10 mVOLTS
METER ZERO CHECKED	✓	ADJUSTED
INSTRUMENT CLEANED	✓	

REPAIR AND PART INFORMATION

Quantity	Description

Repair Time: _____ hours

Comments: Calibrated on the IEMA source blocks in West Chicago on 5/9/2023.

Lab Reference: 36
Certificate No.: 054813