RSSI

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978120

RADIOLOGICAL MEASUREMENTS AT 676 NORTH ST. CLAIR AVENUE CHICAGO, ILLINOIS

FOR:

HARD SURFACE FINISHERS
855 LIVELY BOULEVARD
WOOD DALE, ILLINOIS 60191

ON:

AUGUST 30, SEPTEMBER 19, AND SEPTEMBER 20, 2022

BY:

RSSI
6312 OAKTON STREET
MORTON GROVE, ILLINOIS 60053

OCTOBER 11, 2022

Introduction

On August 30, September 19, and 20, 2022, RSSI measured radiation levels in areas excavated in advance of a sidewalk replacement at 676 North St. Clair Avenue 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 include 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 Ludlum Model 193 meters with shielded Ludlum Model 44-10 gamma scintillation detectors. 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 un-shielded detector maximizes the response to radiation when the probe is used in excavations.

The instrument responses were 880 or 1020 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 approximately 6200 or 7200 cpm above the instrument background (net cpm).

Results

A site approximately 22 feet by 130 feet, situated along the north side of Erie Street was excavated on August 30, September 19, and 20, 2021. Radiation levels were measured inside the exposed area after the upper paver slabs (the preexisting sidewalk) were removed and then again

after a secondary support slab were removed. Additional measurements were made of the root balls of trees removed from the site and the resultant holes. All radiation levels were below the action level. The highest measurements were in the holes of some of the removed trees where around 2000 net cpm, corresponding to around 2.0 pCi/g total radium.

In general, the site was comprised of decorative concrete pavers on top of a layer of rough sand (~1 inch thick), which was on top of a concrete slab (variable thickness, single inches) placed on top of gravel. Other than the pavers, slab, and trees, no material was removed from the site.

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. In the event of additional excavation, radiation levels should be measured to ensure that excavated soils do not exceed the EPA's action level.

Appendix A: Full Results

Table 1: Daily Instrumentation Configuration

Date	**Meter SN**	**Background [cpm]**	**Action Level [gross cpm]**	**Efficiency[1]**
8/30/2022	149073	2400	6248	880
9/19/2022	149080	2000	7242	1020
9/20/2022	149080	2000	7242	1020

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.

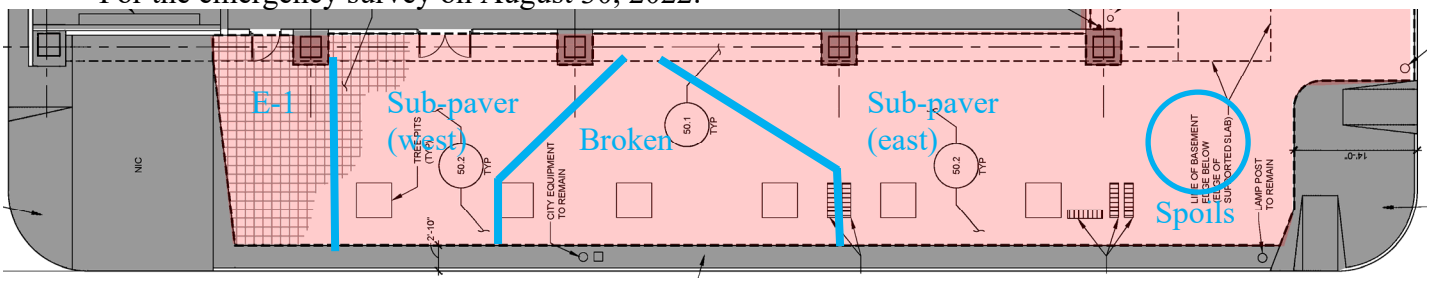
Date	Location[1]	Depth[2]	[Gross cpm]	[net cpm]	Total Radium Concentration [pCi/g]
8/30/22	E-1	SS	2800	400	0.5
8/30/22	E-Sub paver (west)	SS	2800	400	0.5
8/30/22	E-Broken	SS	2800	400	0.5
8/30/22	E-Sub paver (east)	SS	2800	400	0.5
8/30/22	E-Spoils	Spoils	2800	400	0.5
9/19/22	1	SS	2800	800	0.8
9/19/22	2	SS	2800	800	0.8
9/19/22	3	SS	2600	600	0.6
9/19/22	4/Tree 1	SS	3000	1000	1.0
9/19/22	5	SS	2800	800	0.8
9/19/22	6	SS	2800	800	0.8
9/19/22	7/Tree 2	SS	2800	800	0.8
9/19/22	8	SS	2800	800	0.8
9/19/22	9	SS	2800	800	0.8
9/19/22	10/Tree 3	SS	2800	800	0.8
9/19/22	11	SS	2800	800	0.8
9/19/22	12	SS	2800	800	0.8
9/19/22	13/Tree 4	SS	3000	1000	1.0
9/19/22	14	SS	2800	800	0.8
9/19/22	15	SS	2800	800	0.8
9/19/22	16/Tree 5	SS	2800	800	0.8
9/19/22	17	SS	2800	800	0.8
9/19/22	18	SS	2800	800	0.8
9/19/22	19/Tree 6	SS	2800	800	0.8
9/19/22	20	SS	2600	600	0.6
9/19/22	21	SS	2800	800	0.8
9/19/22	1	SSS	3200	1200	1.2
9/19/22	2	SSS	3000	1000	1.0
9/19/22	3	SSS	2800	800	0.8
9/19/22	4/Tree 1	SSS	3200	1200	1.2
9/19/22	5	SSS	3600	1600	1.6
9/19/22	6	SSS	3200	1200	1.2
9/19/22	7/Tree 2	SSS	3000	1000	1.0
9/19/22	8	SSS	2800	800	0.8
9/19/22	9	SSS	3000	1000	1.0
9/19/22	10/Tree 3	SSS	3000	1000	1.0

Date	Location[1]	Depth[2]	[Gross cpm]	[net cpm]	Total Radium Concentration [pCi/g]
9/19/22	11	SSS	3000	1000	1.0
9/19/22	12	SSS	3000	1000	1.0
9/19/22	13/Tree 4	SSS	3600	1600	1.6
9/19/22	14	SSS	3000	1000	1.0
9/19/22	15	SSS	3200	1200	1.2
9/19/22	16/Tree 5	SSS	3200	1200	1.2
9/19/22	17	SSS	3000	1000	1.0
9/20/22	18	SSS	2800	800	0.8
9/20/22	19/Tree 6	SSS	2800	800	0.8
9/20/22	20	SSS	2800	800	0.8
9/20/22	21	SSS	2600	600	0.6
9/20/22	22	SSS	2600	600	0.6
9/20/22	23	SSS	2600	600	0.6
9/20/22	24	SSS	2600	600	0.6
9/20/22	Tree 1	Root ball	3600	1600	1.6
9/20/22	Tree 2	Root ball	3600	1600	1.6
9/20/22	Tree 5	Root ball	3600	1600	1.6
9/20/22	Tree 6	Root ball	3600	1600	1.6
9/20/22	Tree 1	Hole	4400	2400	2.4
9/20/22	Tree 2	Hole	3800	1800	1.8
9/20/22	Tree 3[3]	"Hole"	2800	800	0.8
9/20/22	Tree 4[4]	"Hole"	4000	2000	2.0
9/20/22	Tree 5	Hole	3400	1400	1.4
9/20/22	Tree 6	Hole	4200	2200	2.2

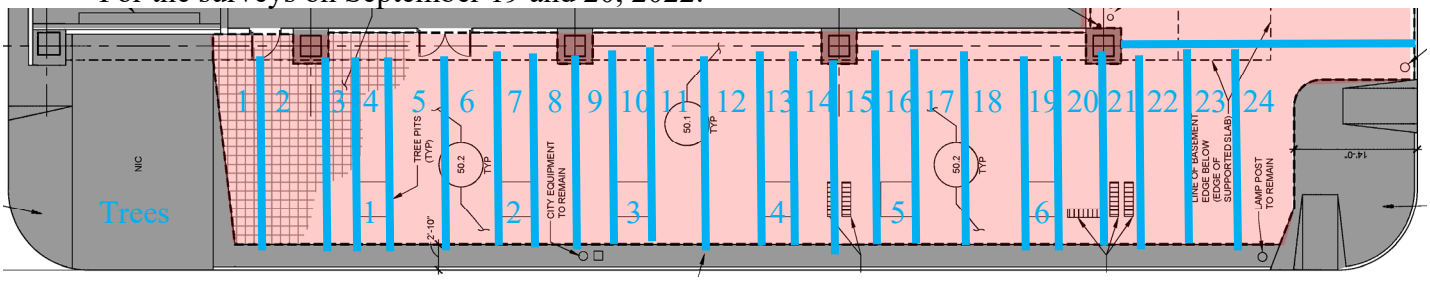
Table Notes:

[1] Locations are identified as follows:

For the emergency survey on August 30, 2022:



For the surveys on September 19 and 20, 2022:



[2] "SS" means sub-slab. SSS means sub-sub-slab (the secondary concrete layer below the pavers). "~On slab" means the area was broken up but the surface had not yet been removed.

[3] Tree 3 was chopped down and somewhat excavated around the root ball.

[4] Tree 4 was not removed, though a pit was dug around the root ball.

Appendix B: Site Photos

Figure: Area E-1, west at top of image

Figure: Area E-Sub paver (west), looking north-northeast

Figure: Area E-Broken, looking east

Figure: Area E-Sub paver (east), looking east

Figure: Area E-Spoils, looking east-southeast

Figure: Site, looking west

Figure: Removed trees

Figure: Tree 3, chopped down

Figure: Tree 4, partially excavated around

Appendix C: Calibration Records

CERTIFICATE OF CALIBRATION

Certificate No. 053831 Rev.

6312 Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991
www.rssi.us

Customer:
RSSI
6312 Oakton Street
Morton Grove, IL 60053-2723
USA

Equipment:

Client ID:	Set #1
Description:	Survey Meter
Manufacturer:	LUDLUM
Model:	193
Serial No.:	149073
Probes:	1
Client ID:	#1
Description:	2”×2” Scintillator
Manufacturer:	LUDLUM
Model No.:	44-10
Serial No.:	PR159705
Cable:	BNC

Where Calibrated:	RSSI
Procedure:	RSSI-80-CAL-0100
Revision:	1
Effective Date:	10/1/2021

CALIBRATION DATA

Source	Description	Unit	Scale	Reference Cal. Point	Reading	
					Before Adjustment	After Adjustment
3	Count rate	cpm	x1	200	210	200
				800	820	800
3	Count rate	cpm	x10	2 K	2.1 K	2.0 K
				8 K	8.2 K	8.0 K
3	Count rate	cpm	x100	20 K	21 K	20 K
				80 K	82 K	80 K
3	Count rate	cpm	x1000	200 K	210 K	200 K
				800 K	820 K	800 K

Uncertainty values available on request.
A correction factor is supplied if the accuracy of a scale is not within ±10% but is within ±20%.

Probe	Background	Check Source		
		Radionuclide	Reading	Orientation
LUDLUM 44-10, 3’ cable	6000 cpm	Ba-133	300 kcpm	Number away from detector with red plastic endcap on probe
LUDLUM 44-10, 25’ cable	2500 cpm		120 kcpm	

Comments: Check source readings taken with the un-shielded probe, but with the probe wrapped in electrical tape/plastic bag/electrical with a red plastic endcap as for field use.

Revision Note: Efficiencies and USEPA action levels for thorium, radium, and uranium added based on IEMA source block calibration from 5/3/22.

Lab Reference: 2

Calibration performed at RSSI’s calibration facility in Morton Grove, Illinois, which is authorized by Illinois Emergency Management Agency license number IL-01429-01 and accredited to the ISO/IEC 17025:2017 standard by Perry Johnson Laboratory Accreditation (PJLA) under accreditation number 101315, calibration certificate L21-760.

PJLA Calibration
Accreditation #101315
ISO/IEC 17025:2017

CALIBRATION STANDARDS

Source / Equipment	Description	Manufacturer/Model	Serial No.	Traceable Ref.	Calibrated
3	Electronic pulser	Ludlum 500	32789	20405864/512664	7/8/2019
BAT	Multimeter	Fluke 77	38329162		
HV	Multimeter	Fluke 77	38309810		
	HV probe	Fluke 80K-40	35420030		

PREVENTIVE MAINTENANCE PERFORMED

Preventative Maintenance	Equipment Used	Check	Notes
Batteries/Contacts Checked[1]	BAT	✓	REPLACED
High Voltage Measured	HV	✓	883 VOLTS
Sensitivity Measured[2]	3	✓	11 mVOLTS
Meter Zero Checked		✓	
Instrument Cleaned		✓	

Note 1: Alkaline batteries are replaced if the voltage is less than 1.4 V.
Note 2: Instruments are pulsed at ~2× the sensitivity.

REPAIRS AND PARTS

Repair/Part	Quantity	Notes
D-cell Batteries	2	

Calibrated by: _____ **Date**: 04/14/22 Rev. 8/30/22
Aaron Morris
Calibration Frequency: Annual **Recalibrate by**: 04/14/23

Ludlum 44-10 Efficiencies (net cpm / pCi/g)

	Thorium		Radium		Uranium	
	Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
3' Cable	880	2,060	780	1,860	120	330
25" Cable	460	880	400	780	80	145

Ludlum 44-10 US EPA Action Levels (net cpm at 7.1 pCi/g)

	Thorium		Radium		Uranium	
	Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
3' Cable	6,248	14,626	5,538	13,206	852	2,343
25" Cable	3,266	6,248	2,840	5,538	568	1,030

This certificate relates only to the specific instrument and probe(s) calibrated. Calibration due dates appearing on this certificate and the calibration labels are determined by the client for administrative or regulatory purposes and do not imply continued conformance to specifications.

Calibration was performed at RSSI's calibration facility in Morton Grove, Illinois, which is authorized by Illinois Emergency Management Agency license number IL-01429-01 and meets the requirements of ANSI 323-1978, MIL-STD-45662A, and ISO/IEC 17025:2017.

This instrument has been calibrated using standards traceable through NIST or another National Metrology Institute to the International System of Units (SI Units), derived from natural physical constants, ratio measurements, or other national measurements and standards. Unless otherwise noted, the method of calibration is by direct comparison to a traceable standard.

All pass/fail determinations are based on the manufacturer's specifications without considering uncertainties.

CERTIFICATE OF CALIBRATION

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

Certificate No. 053974 Rev. 2

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		Uranium	
Cable Length	**3'**	**25'**	**3'**	**25'**	**3'**	**25'**
Shielded	**1,020**	**298**	**820**	**258**	**155**	**49**
Unshielded	**1,920**	**410**	**1,920**	**380**	**360**	**70**

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

	Thorium		Radium		Uranium	
Cable Length	**3'**	**25'**	**3'**	**25'**	**3'**	**25'**
Shielded	**7,242**	**2,116**	**5,822**	**1,832**	**1,101**	**348**
Unshielded	**13,632**	**2,911**	**13,632**	**2,698**	**2,556**	**497**

Check Source: Ba-133 **Reading:** 220 kcpm **Cable Length:** 3'
Check Source: Ba-133 **Reading:** 54 kcpm **Cable Length:** 25'

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

Calibrated by: _____ **Date**: 05/03/22 (Rev. 10/11/22)

Calibration Frequency: Annual **Recalibrate by**: 05/03/23

***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 2785 transfer instrument. Radcal Cert. of Conf. S124230.

PREVENTIVE MAINTENANCE PERFORMED

BATTERIES/CONTACTS CHECKED	✓	
HIGH VOLTAGE MEASURED	✓	882 VOLTS
SENSITIVITY MEASURED	✓	10 mVOLTS
METER ZERO CHECKED	✓	
INSTRUMENT CLEANED	NA	

REPAIR AND PART INFORMATION

Quantity	Description

Repair Time: _____ hours

Comments: Revised to add source block efficiency information and check source values.\
Revised to correct revision year to 2022.

Lab Reference: 5