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993087

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

FOR:

GEOTHINK, LLC
530 VIKING DRIVE
SYCAMORE, ILLINOIS 60178

ON:

MAY 20, 2024

BY:

RSSI
6312 OAKTON STREET
MORTON GROVE, ILLINOIS 60053

MAY 31, 2024

Introduction

On May 20, 2024, RSSI measured radiation levels from subsurface borings as part of a site evaluation at NBC Tower, 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 700 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 4970 cpm above the instrument background (net cpm).

Results

A Geoprobe was used to remove subsurface cores from five sites in the exterior driveway for a parking garage and from the exit lane of the garage. Once removed from the Geoprobe, the cores were surveyed before material was extracted for [non-radiological] environmental testing. Any excess material was poured back down the boreholes before they were capped with concrete.

All radiation levels were below the action level. The highest measurement of around 600 net cpm was seen in the 5'-10' core from hole D. 600 net cpm corresponds to around 0.9 pCi/g total radium.

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

<u>Date</u>	<u>Meter SN</u>	<u>Background [cpm]</u>	<u>Action Level [gross cpm]</u>	<u>Efficiency¹</u>
5/20/2024	149073	2200	7170	700

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

Table Notes:

¹ Efficiency is measured in net cpm per pCi/g total radium based on thorium block calibration.

Table 2: Walk-over Survey Results from 5/10/2024

Hole	Depth	[Gross cpm]	[Net cpm]	Total Radium Concentration [pCi/g]	Notes
D	0'-5'	2400	200	0.3	
D	5'-10'	2800	600	0.9	
D	10'-15'	2400	200	0.3	Wet sand
E	0'-5'	2000	0	0.0	
E	5'-10'	2400	200	0.3	
E	10'-15'	1800	0	0.0	Refusal at 11', tarry
B (BX)	0'-5'	2200	0	0.0	Gravel
B (BX)	5'-10'	2200	0	0.0	Refusal at 9', gravel
B'	0'-5'	2200	0	0.0	Gravel
B'	5'-10'	2400	200	0.3	Gravel
B'	10'-15'	2400	200	0.3	Wet sand
B'	15'-20'	2000	0	0.0	Water table
A	0'-5'	2400	200	0.3	
A	5'-10'	2000	0	0.0	
A	10'-15'	2000	0	0.0	
A	15'-20'	2200	0	0.0	
A	20'-25'	2000	0	0.0	
A	25'-30'	1800	0	0.0	
C''	0'-5'	2000	0	0.0	
C''	5'-10'	2400	200	0.3	
C''	10'-15'	2200	0	0.0	Wet
C''	15'-20'	2200	0	0.0	Wet
C''	20'-25'	2200	0	0.0	Wet
C''	25'-30'	2200	0	0.0	Wet

Notes: Hole B was renamed as BX after the Geoprobe could not sample below 9'. A new hole location, B', was then cored nearby.

Holes C (renamed to CX) and C' (renamed to C'X) were both refused within the first 5 feet and no material was extracted. A nearby hole, C'', was cored instead.

Appendix B: Figures

Figure 1: Holes D (upper left) and E (lower right) (looking north)



Figure 2: Holes B (BX) (middle) and B' (with pipe)



Note: The filled-in hole on the left of the image is from a previous boring project.

Figure 3: Hole A (center) (filled) (looking north)



Note: The filled-in hole on the left of the image is from a previous boring project.

Figure 4: Holes C' (C'X) (upper), C (CX) (right), and C'' (with pipe and spool) (looking north)



Appendix C: Calibration Records



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consult@rssi.us

CERTIFICATE OF CALIBRATION

Certificate No. 055566

RSSI
 6312 Oakton Street
 Morton Grove, IL 60053-2723

Manufacturer: LUDLUM
Model: 193
Serial No.: 149073
Probe(s): LUDLUM 44-10, Sn: PR159705 (#1)

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	700	2,020	1,000	2,520
25" Cable	426	670	506	1,100

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

	Thorium		Radium	
	Shielded	Unshielded	Shielded	Unshielded
3' Cable	4,970	14,342	7,100	17,892
25" Cable	3,025	4,757	3,593	7,810

Check Source: Ba-133 **Reading:** 260 kcpm **Cable Length:** 3'
Check Source: Ba-133 **Reading:** 120 kcpm **Cable Length:** 25'

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

Calibrated by: Aaron J. Morin **Date:** 05/06/24

Calibration Frequency: Annual **Recalibrate by:** 05/06/25

*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	12/14/2023	

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 the International System of Units (SI) through the national standard of Canada with a Radcal model 2186 (SN 27-0593) transfer instrument. NRC-CNRC Exposure Calibration Reports IRS-2023-3949, IRS-2023-3950, and IRS-2023-3951.

PREVENTIVE MAINTENANCE PERFORMED

BATTERIES/CONTACTS CHECKED	✓	1.60, 1.60 V
HIGH VOLTAGE MEASURED	✓	883 V
SENSITIVITY MEASURED	✓	10 mV
METER ZERO CHECKED	✓	
INSTRUMENT CLEANED	✓	

REPAIR AND PART INFORMATION

Quantity	Description

Repair Time: _____ hours

Comments: _____

Lab Reference: 2
Certificate No.: 055566