Stan A. Huber Consultants, Inc.
Health Physics and Radiation Safety Services

200 North Cedar Road – New Lenox, Illinois 60451-1751 – (800) 383-0468 or (815) 485-6161 – FAX (815) 485-4433 – Email sahci@sahci.com – Home Page www.sahci.com

December 19, 2022

978959

Angel Camacho
SET Environmental
450 Sumac Road
Wheeling, Illinois 60090

RE: Thorium Monitoring – City of Chicago Department of Water Management
CDOT Permit: 1734346 – 500-731 N. St. Clair St.
Interim Report: 9/27/22 – 12/17/22

Dear Mr. Camacho:

Stan A. Huber Consultants, Inc (SAHCI) was hired by your firm to provide radiation monitoring during the excavation for a new water main installation at 500-731 N. St. Clair Street in Chicago, Illinois.

The monitoring was performed by Brian Schmidt, SAHCI Health Physics Technician, from September 27, 2022 through November 11, 2022. All activities were conducted under the guidance of document *SET General Procedure for Thorium Monitoring.*

This project has not been completed yet. Thorium contamination exceeding the 7.1 picocuries per gram (pCi/g) action level was identified on October 18, 2022 and has not been remediated yet.

Instrumentation

Surface gamma scans were performed using a Ludlum Model 2221 Scaler / Ratemeter (serial no. 126496) with attached Ludlum Model 44-10 2”x2” NaI Detector (w/ 6” collimated lead shield). The instrument was calibrated on May 3, 2022. The US Environmental Protection Agency (USEPA) threshold limit of 7.1 pCi/g total thorium for this instrument is 7,819 counts per minute (cpm).

The average background count rate for these locations was measured at 1,914 cpm.

Soil Gamma Scans

Gamma surface scans were performed using the Ludlum Model 2221 Scaler / Ratemeter described above. Survey data was collected by entering the excavation and recording the highest count rate for the floor and walls to a maximum depth of 48 inches below ground surface. Material excavated below 48 inches was monitored in the

excavator bucket as it was removed. All asphalt, concrete, and soil were loaded directly into a truck for disposal.

The maximum gamma count rate for each lift was recorded on Attachment A - Radiation Survey Form. A maximum count rate of 74,000 cpm was observed was in Area 43. See below for additional details. Except for Area 43, the count rates in the excavations ranged from 1,600 cpm to 5,500 cpm.

Soil Contamination

On October 18, 2022, count rates exceeding the 7.1 pCi/g threshold limit were observed in Area 43. This location is approximately 40 feet north of the alley between Illinois St. and Grand Ave. The length of the trench in 18 feet long and 4 feet wide. The maximum count rate of 74,000 cpm was identified 2 feet below ground surface. Since the contamination has not yet been removed, the maximum depth is unknown at this time. A separate survey form, Attachment B – Exclusion Zone Figure, is attached which details the area of contamination.

On October 18, 2022, Glenn Huber visited the site to evaluate the elevated count rates and collect a gamma spectroscopy sample. The maximum count rate area of 74,000 cpm could not be located since the soil was likely blended when temporarily backfilled. Therefore a 500 ml composite sample was collected from areas ranging from 8,000 cpm to 22,000 cpm. The sample was then shipped to RSSI in Morton Grove, IL for analysis.

The sample analysis showed a radium-226 concentration of 0.84 pCi/g and a radium-228 concentration of 26.41 pCi/g. See Attachment C – Gamma Spectroscopy Report.

A dose rate survey was performed in the excavation with a Bicron Model MicroRem Tissue Equivalent Gamma Scintillator (serial No. C258C). The dose rates ranged from 5 to 8 microrem per hour

Personnel working near the contaminated excavation were screened for surface contamination using a Ludlum Model Survey Meter (serial no. 95056) with attached Ludlum Model 44-9 G-M Detector. No count rates over background levels were observed.

A removable contamination smear was collected on the excavator bucked which initially handled the contaminated soils. The smear was analyzed on a Ludlum Model 2929 Alpha/Beta Counter. All removable contamination was below the guideline values of 33 disintegrations per minute per 100 centimeters squared (dpm/100cm^2) alpha and 222 cpm/100 cm^2 beta. See Attachment D – Radiation Survey Form Removable Contamination.

Contaminated soils were placed back into the excavation a steel plate was placed over it.

Additional Monitoring

Cleanup of the contaminated area has not yet taken place and arrangements for transportation and disposal are being made. Once the area has been cleaned up and verified, a separate report will be prepared.

I will be providing a copy of this report to both the City of Chicago Department of Public Health and US Environmental Protection Agency, as required.

Thank you for your assistance with this project. If you have any questions or need additional information, please call me at (815) 485-6161.

Sincerely,
Stan A. Huber Consultants, Inc.

Glenn Huber, CHP
President

Attachment A

Radiation Survey Forms

500-731 N. Grand Avenue DWM

Stan A. Huber Consultants, Inc.
200 N. Cedar Rd.
New Lenox, IL 60451

sahci
Stan A. Huber Consultants, Inc.

Radiation Survey Form

Location/ Project ID: DWM - St. Clair St. - Testpit Excavation - Raw Radiological Soil Survey

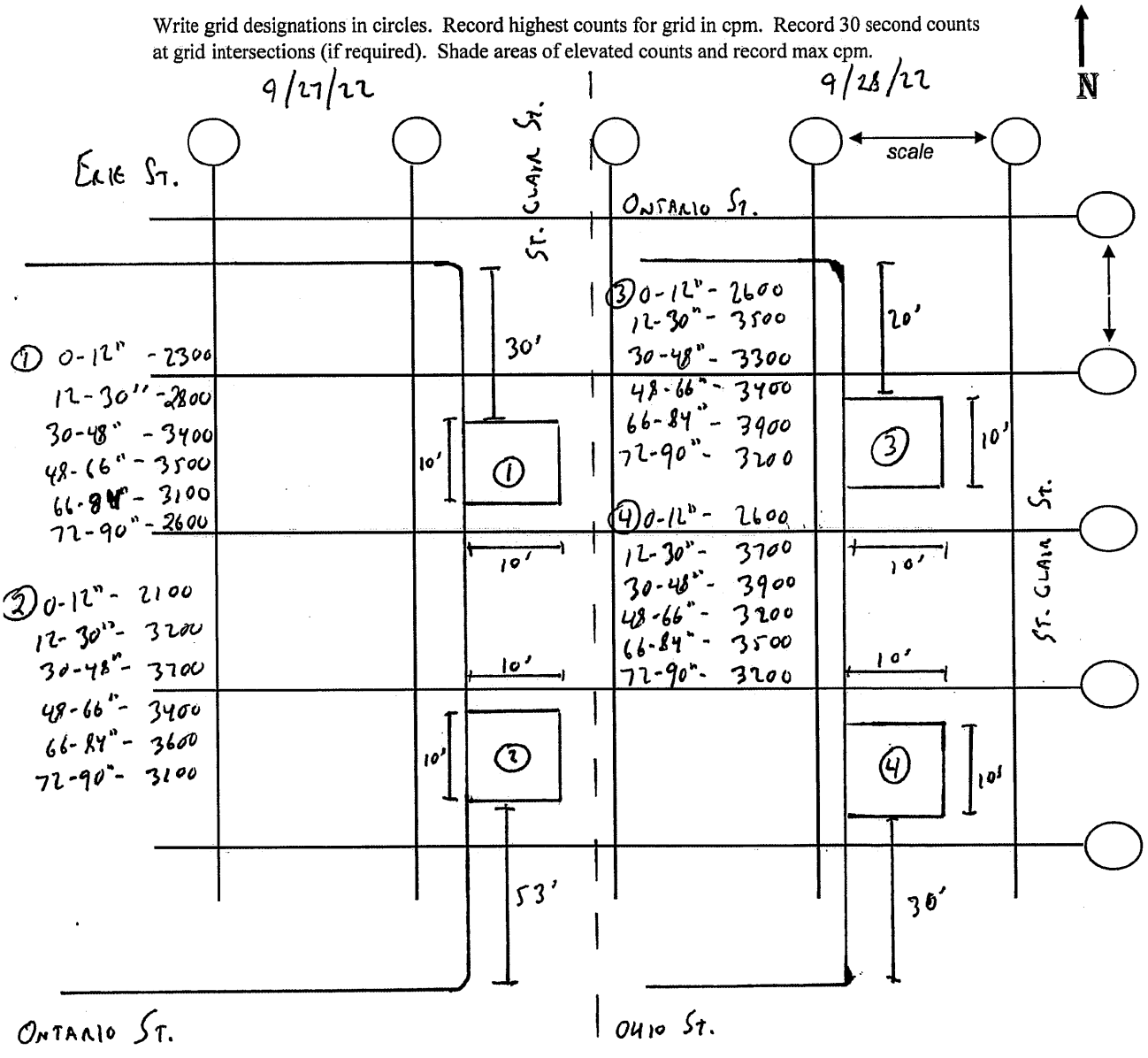
Date: 9/27-28/2022 **Technician:** Brian Schmidt

Inst Model: Ludwm - 2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / 2"x2" NaI (Shielded) / Not Shielded **Lift Elevation:** 0-72"

Background 1914 **cpm** **Action Level:** 7819 **cpm**

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



sahci
Stan A. Huber Consultants, Inc.

Radiation Survey Form

Location/ Project ID:

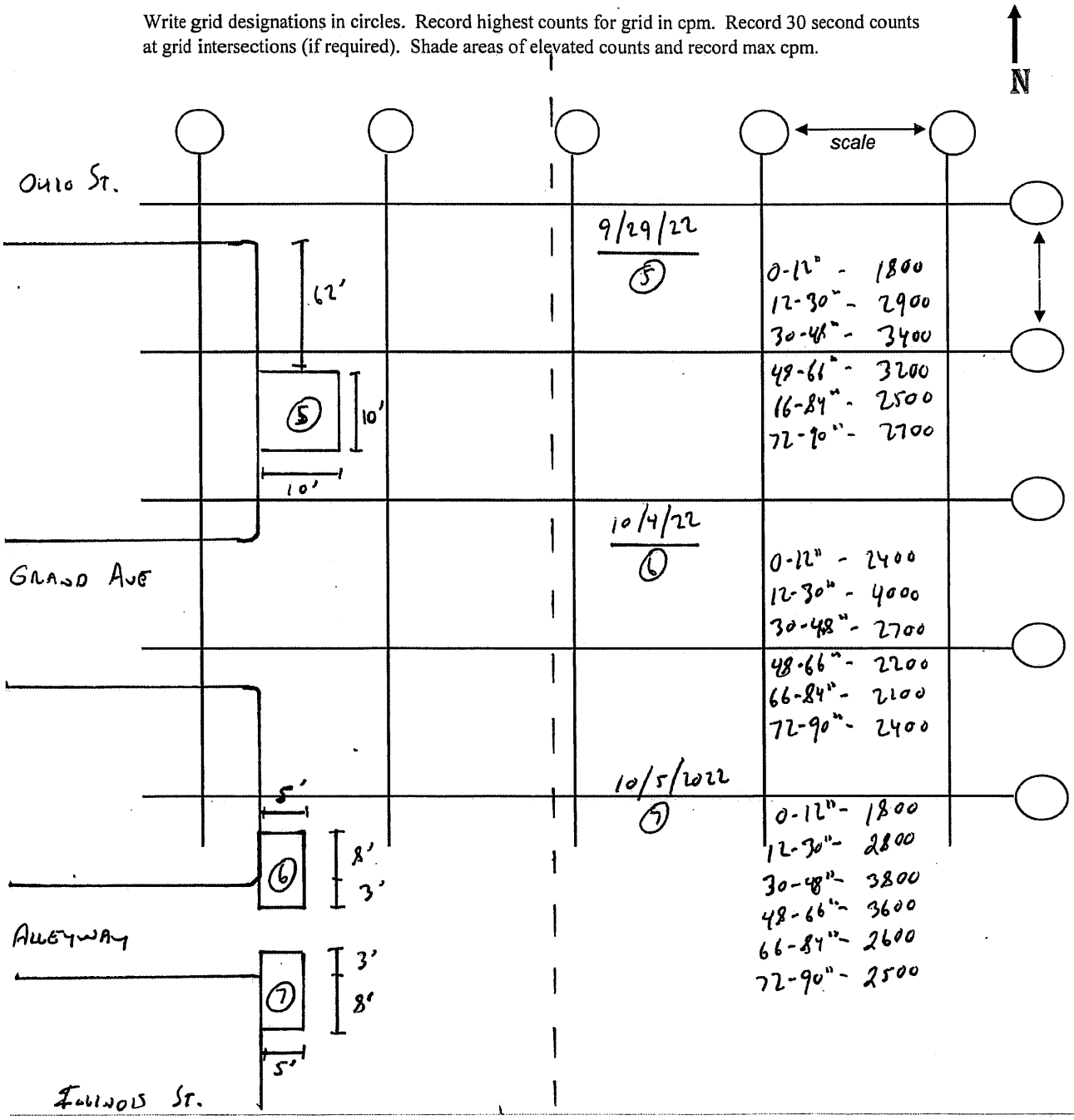
Date: 9/29/22 + 10/4-5/2022 **Technician:** Brian Schmidt

Inst Model: Cyclone - 2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / ~~2"x2" NaI~~ **Lift Elevation:** 0-72"
~~Shielded~~ / Not Shielded

Background 1914 **cpm** **Action Level:** 7819 **cpm**

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



9/29/22
(5)
0-12" - 1800
12-30" - 2900
30-48" - 3400
48-61" - 3200
16-84" - 2500
72-90" - 2700

10/4/22
(6)
0-12" - 2400
12-30" - 4000
30-48" - 2700
48-66" - 2200
66-84" - 2100
72-90" - 2400

10/5/2022
(7)
0-12" - 1800
12-30" - 2800
30-48" - 3800
48-66" - 3600
66-84" - 2600
72-90" - 2500

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Radiation Survey Form

Location/ Project ID: DWM - St. Clair St - Water Main / Catch Basin / Sewer / Hydrant Excavation - ROW Radiological Soil Survey

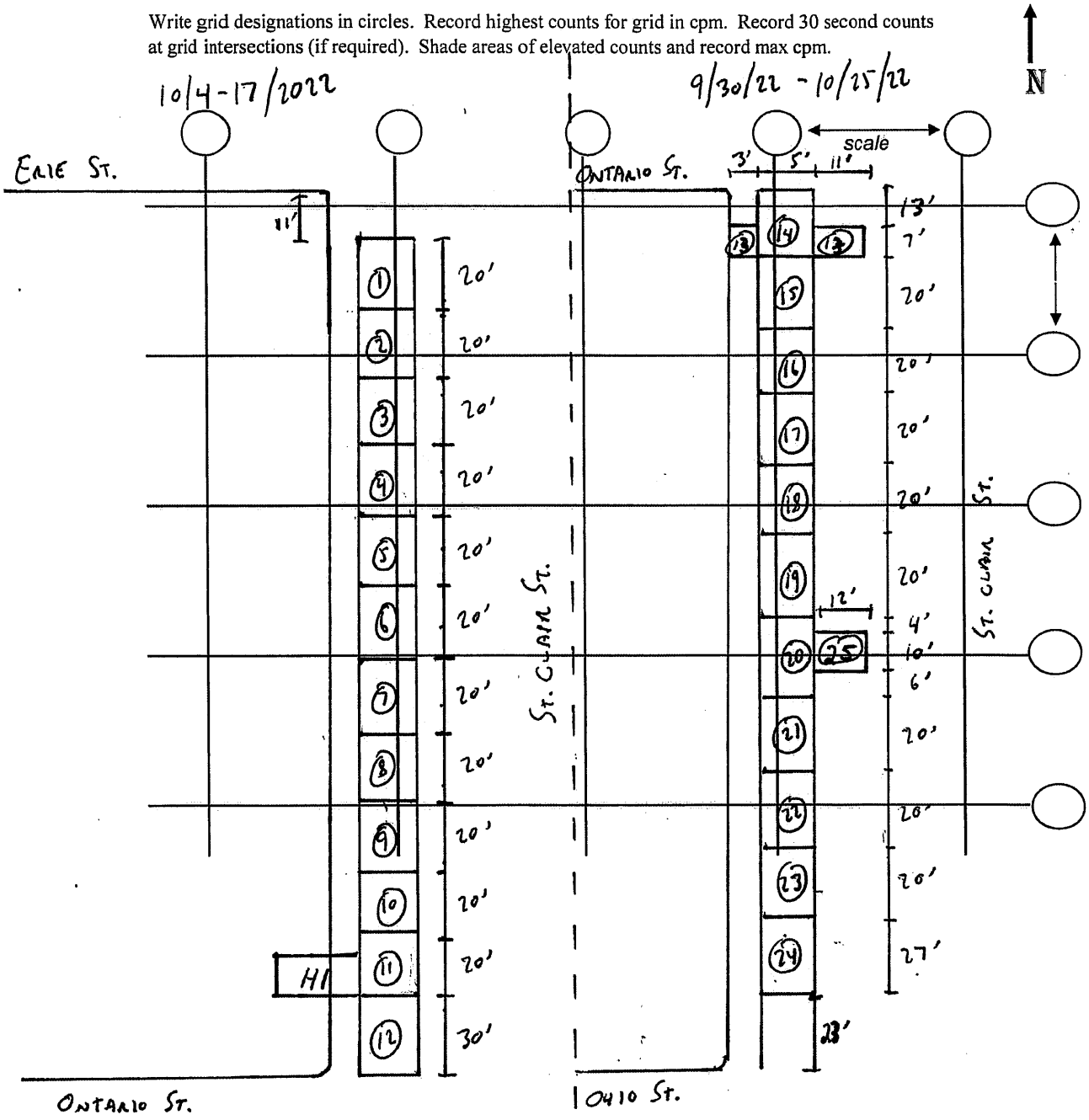
Date: 10/4-17/2022 / 9/30/22-10/25/22 **Technician:** Brian Schmidt

Inst Model: Ludlum-2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / (2"x2" NaI) Shielded / Not Shielded **Lift Elevation:** 0-72"

Background 1914 **cpm** **Action Level:** 7819 **cpm**

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



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Radiation Survey Form

Location/ Project ID: DWM - St. Clair St - Water Main/CatchBasin/Sewer/Hydrant Excavation - Raw Radiological Soil Survey

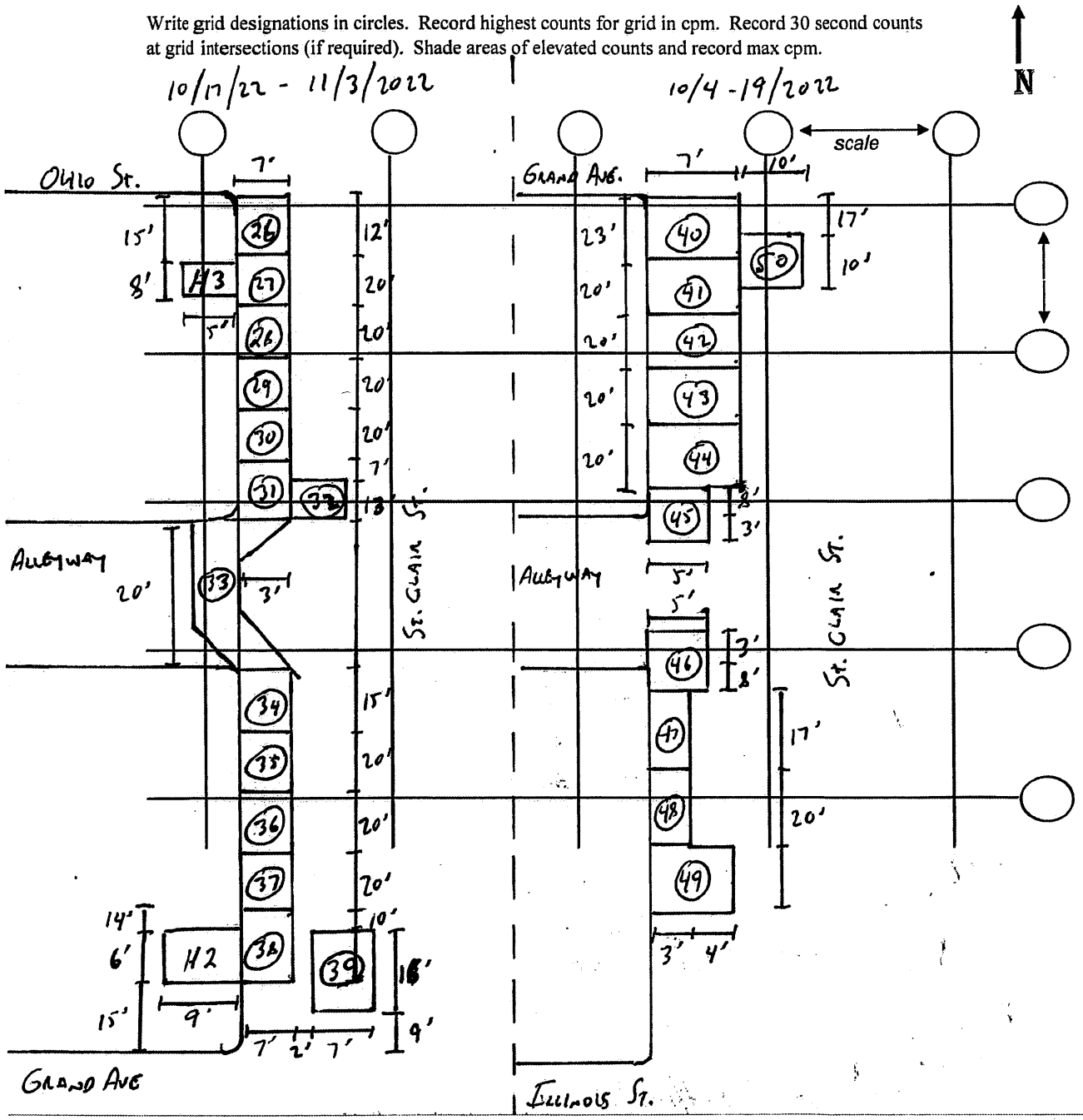
Date: 10/4/2022 - 11/3/2022 **Technician:** Brian Schmidt

Inst Model: Ludlum-2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / 2"x2" NaI (Shielded) / Not Shielded **Lift Elevation:** 0-72"

Background 1914 **cpm** **Action Level:** 7819 **cpm**

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



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Radiation Survey Form

Location/ Project ID: DWM - St. Clair St. - Water Main / Catch Basin / Sewer / Hydrant Excavation - ROW Radiological Soil Survey

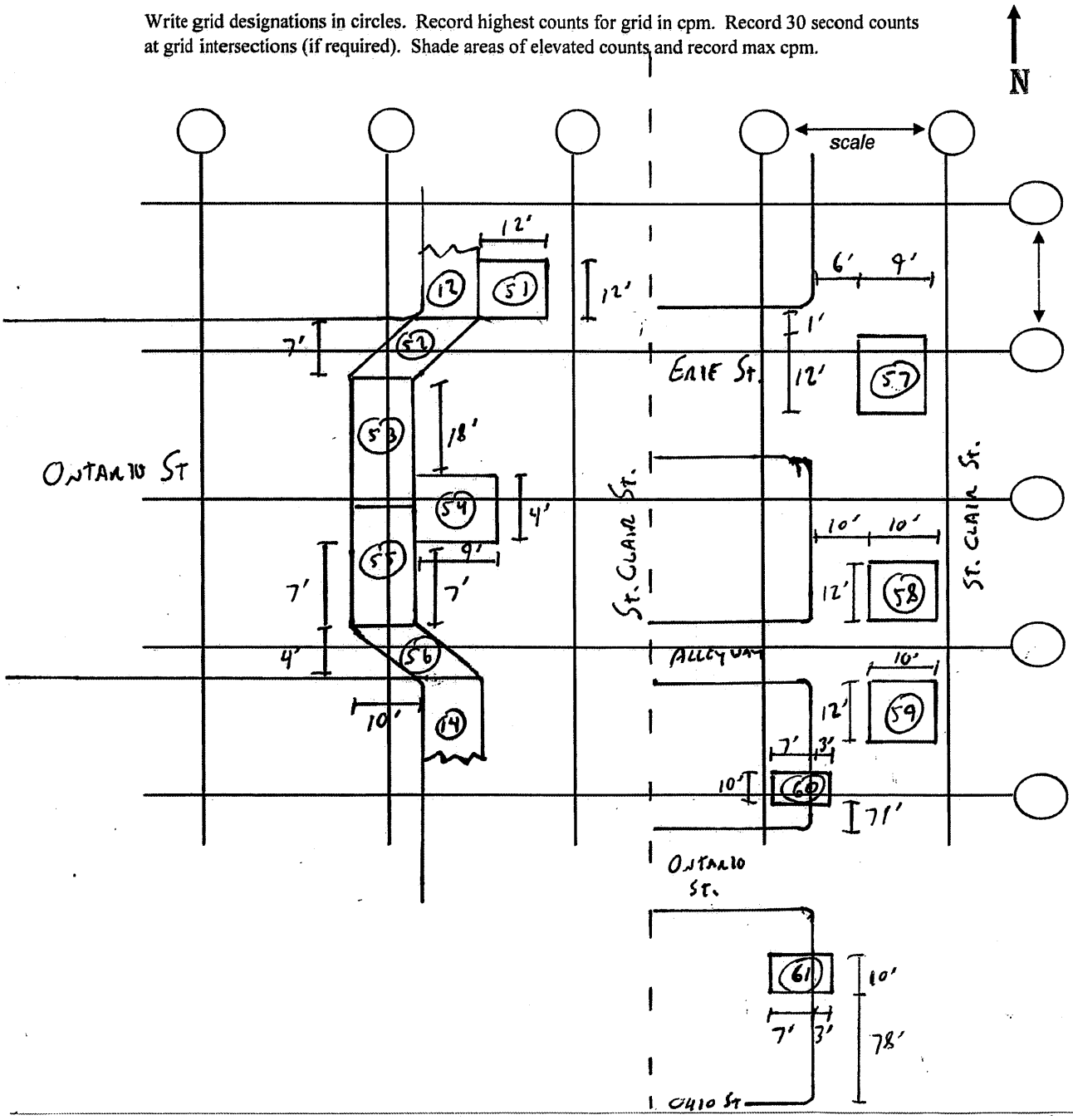
Date: 10/11-24/2022 + 11/7-9/22 **Technician:** Brian Schmidt

Inst Model: Ludlum - 2221 **Serial No. :** 126496

Probe Type: 1"x1" Nal / 2"x2" Nal (Shielded) / Not Shielded **Lift Elevation:** 0-72"

Background 1914 cpm **Action Level:** 7819 cpm

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



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Stan A. Huber Consultants, Inc.

Radiation Survey Form

Location/ Project ID: DWM - St. Clair St - Water Main/Catch Basin/Sewer/Hydrant Excavation - ROW Radiological Soil Survey

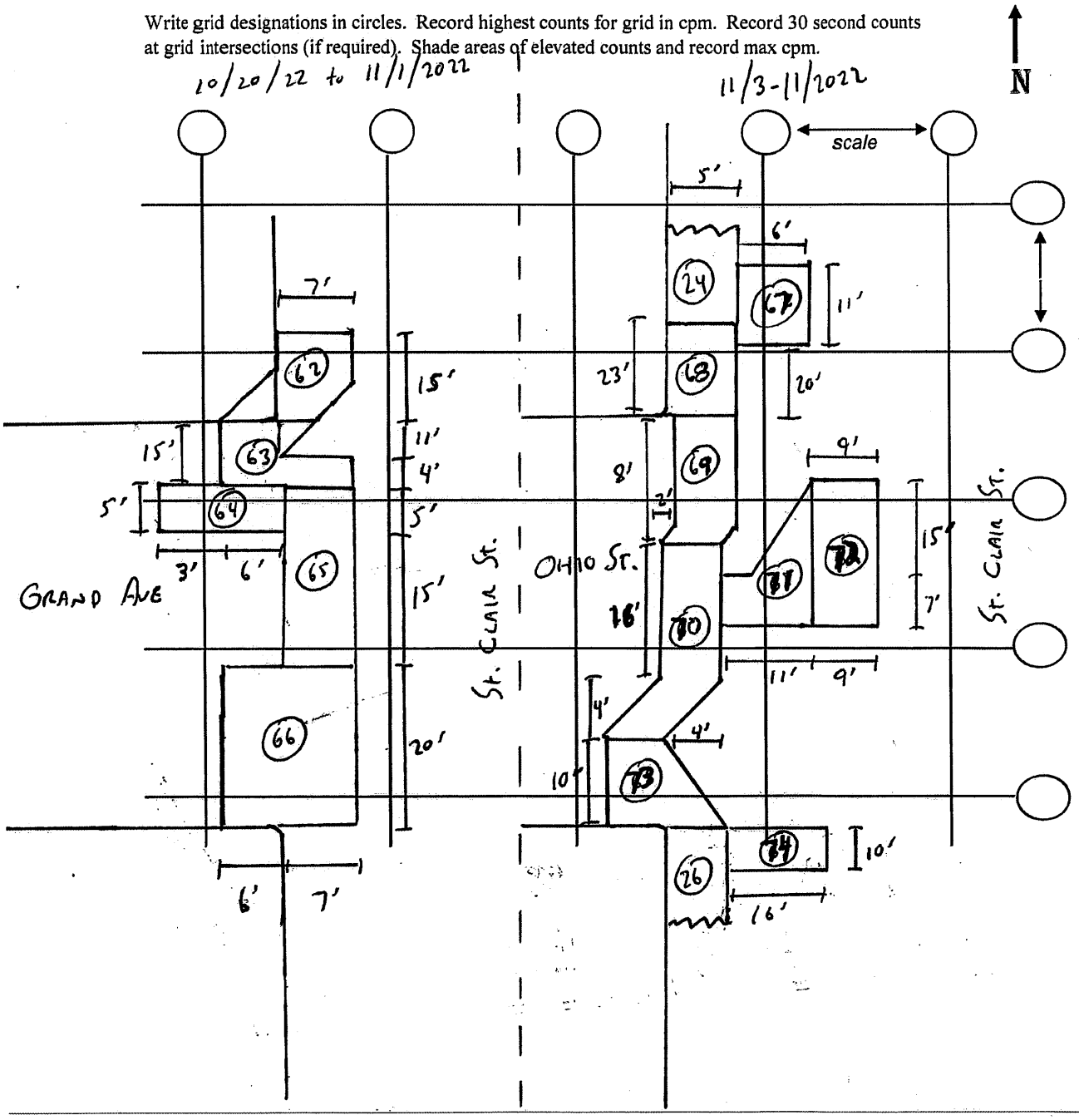
Date: 10/20/22 to 11/1/22 & 11/3-11/22 **Technician:** Brian Schmidt

Inst Model: Ludlum-2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / (2"x2" NaI) (Shielded) / Not Shielded **Lift Elevation:** 0-72"

Background 1914 cpm **Action Level:** 7819 cpm

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



Radiation Survey Form

DWM St. Clair Street Thorium Survey Results

Technician:	Brian Schmidt			Background: 1914 cpm		
Project ID:	DWM St. Clair Street					
Instrument ID:	Ludlum Model 2221 w/ Ludlum Model 44-10			7.1 pCi/g TH FAL: 7,819 cpm		
	w/ 6" shield (serial no. 126496)					

Date	Area #	0-12"	12-30"	30-48"	48-66"	66-84"	72-90"
10/17/2022	1	2200	2400	2800	3300	3200	2700
10/4/2022	2	1800	2000	3100	3400	3700	3400
10/4/2022	3	1900	2400	2900	3000	3600	3300
10/4/2022	4	1700	2600	2800	3100	3900	3500
10/4/2022	5	1800	2400	2700	3200	3800	3600
10/4/2022	6	2100	2600	3200	3500	3700	3900
10/5/2022	7	2300	2600	2800	2600	3200	3400
10/5/2022	8	1700	2200	2900	3400	3600	3900
10/5/2022	9	1900	2700	3800	3600	3900	3200
10/5/2022	10	1700	2900	3400	3900	4100	3600
10/6/2022	11	1700	2700	3200	3600	3900	3500
10/6/2022	H1	1600	3000	3600	3800	3400	3200
10/11/2022	12	2400	2800	3400	3300	3600	4100
10/25/2022	13	1800	2600	2900	3200	3700	3500
10/13/2022	14	1800	2400	3800	4100	3600	3200
9/30/2022	15	2100	2800	3600	3100	3400	2700
9/30/2022	16	2000	3000	4100	3500	3900	3200
9/30/2022	17	1800	2500	2900	3200	3900	3100
9/30/2022	18	2400	3600	3600	3700	4100	3200
9/30/2022	19	1900	2700	3300	3100	3400	3800
9/30/2022	20	1700	2500	2700	3300	3600	3400
10/1/2022	21	1900	2900	3600	4200	3700	3400
10/1/2022	22	2000	3000	3300	3600	3100	3100
10/1/2022	23	2300	3400	3900	3200	3600	4100
10/3/2022	24	1700	2800	3100	3800	3500	3700
10/1/2022	25	2400	2700	3400	3600	2800	2900
10/31/2022	26	1800	2400	2700	2900	3200	2900
10/25/2022	27	2000	2800	3000	3500	2900	2600
10/25/2022	28	1800	2600	3400	3100	3000	2800
10/27/2022	29	2300	2600	3100	3400	2800	3500
10/24/2022	30	2100	2400	2700	3000	2800	3000
10/20/2022	31	2800	3100	3700	3900	3100	2800
11/2/2022	32	2000	2600	3200	3700	3100	2800
10/19/2022	33	2200	2600	3600	3400	2900	2400
10/18/2022	34	2100	2500	3400	3200	2900	2600

Date	Area #	0-12"	12-30"	30-48"	48-66"	66-84"	72-90"
10/18/2022	35	2600	3700	2800	3300	2900	3400
10/18/2022	36	2700	3200	3400	3100	3500	3300
10/17/2022	37	2500	4200	4100	3600	3900	2800
10/17/2022	38	1900	2600	3000	3200	3400	2800
11/3/2022	39	1900	2300	2600	3200	2900	2700
10/17/2022	H2	2400	2700	2900	2500	2600	2800
10/31/2022	H3	1700	2600	3000	3400	3800	2900
10/19/2022	40	2500	2900	4100	3600	3100	2800
10/19/2022	41	2500	3100	3600	3900	3400	2900
10/19/2022	42	2300	3200	3400	4600	5500	4000
10/18/2022	43	* - Contamination Found 10/18/2022 - Max Value 74,000 cpm					
10/17/2022	44	2200	3600	3300	3900	3800	3400
10/4/2022	45	2400	4000	2700	2200	2100	2400
10/5/2022	46	1800	2800	3800	3600	2600	2500
10/17/2022	47	1700	2900	3300	3400	3600	3100
10/17/2022	48	2300	2900	3100	3700	3400	3200
10/6/2022	49	2400	3600	2800	3200	3200	2800
10/19/2022	50	2600	3100	3300	3400	3300	2900
10/24/2022	51	1700	2300	3500	3300	3100	2600
10/11/2022	52	2200	3000	2700	3400	3200	3600
10/12/2022	53	1700	2400	3200	3700	3600	3100
11/8/2022	54	1600	2300	2700	2700	2600	2400
10/13/2022	55	2000	2900	3400	3600	3100	2600
10/13/2022	56	1600	2400	3200	3600	4200	3800
10/17/2022	57	1600	2400	1700	1900	2600	2200
10/18/2022	58	1900	2600	2800	2800	3400	3200
10/19/2022	59	1800	2200	2700	3200	3200	2400
11/7/2022	60	2300	2900	3100	3300	2800	2600
11/9/2022	61	1900	2600	3100	3600	2600	2200
10/27/2022	62	1900	2300	3200	3400	3500	2800
10/27/2022	63	1700	2800	3400	3700	4200	3200
11/1/2022	64	2300	2800	3600	3900	3400	2800
10/27/2022	65	2100	2500	2800	3600	2900	3200
10/20/2022	66	2400	2800	3200	3900	4100	3400
11/11/2022	67	1800	2500	3300	3700	3200	2600
11/10/2022	68	2600	3400	3300	3600	2900	2700
11/1/2022	69	1800	2200	2900	3400	3200	2600
10/31/2022	70	2200	2400	3100	3300	3500	3000
11/3/2022	71	1900	2100	2600	3300	3800	3200
11/3/2022	72	1700	2400	2900	3300	3100	2800
10/31/2022	73	2100	2600	3500	2800	3200	3600
11/7/2022	74	2100	2700	3200	2800	2800	2500

All results in counts per minute (cpm)

Radiation Survey Form

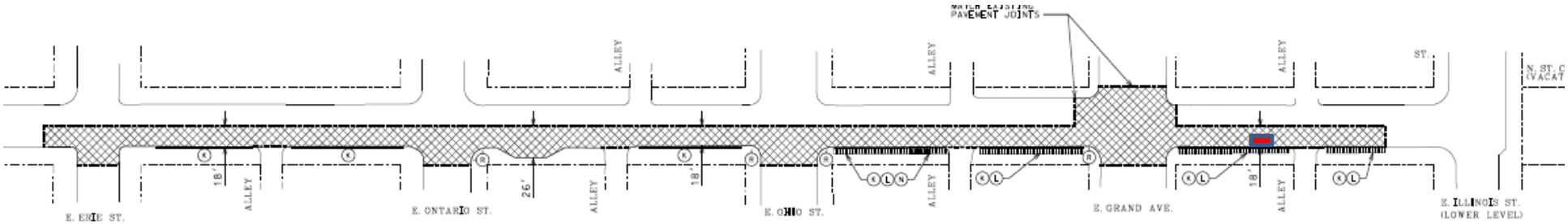
DWM St. Clair Street Thorium Survey Results

Technician:	Brian Schmidt				Background: 1914 cpm	
Project ID:	DWM St. Clair Street					
Instrument ID:	Ludlum Model 2221 w/ Ludlum Model 44-10 NaI				7.1 pCi/g Th FAL: 7,819 cpm	
	w/ 6" shield (serial no. 126496)					

Date	Area #	0-12"	12-30"	30-48"	48-66"	66-84"	72-90"
9/27/2022	1	2300	2800	3400	3500	3100	2600
9/27/2022	2	2100	3200	3700	3400	3600	3100
9/28/2022	3	2600	3500	3300	3400	3900	3200
9/28/2022	4	2600	3700	3900	3200	3500	3200
9/29/2022	5	1800	2900	3400	3200	2500	2700
10/4/2022	6	2400	4000	2700	2200	2100	2400
10/5/2022	7	1800	2800	3800	3600	2600	2500

All results in counts per minute (cpm)

Project Location 500-731 N. St. Clair



Attachment B

Exclusion Zone Figure

500-731 N. Grand Avenue DWM

Stan A. Huber Consultants, Inc.
200 N. Cedar Rd.
New Lenox, IL 60451

sahci
Stan A. Huber Consultants, Inc.

Radiation Survey Form

Location/ Project ID: 500-731 N. St Clair St.

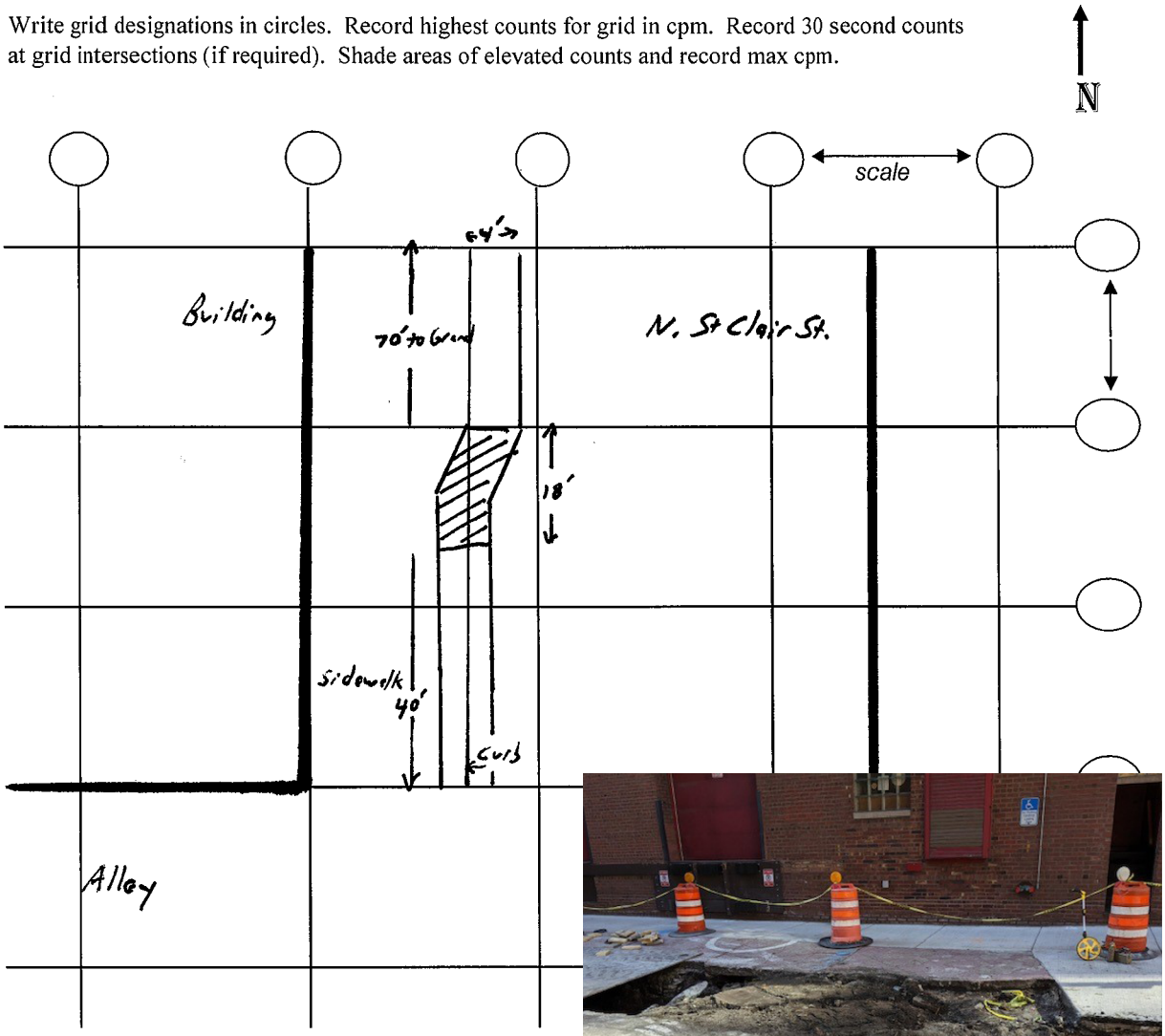
Date: 10/18/22 **Technician:** Brian Schmidt

Inst Model: Ludlum 2221 **Serial No. :** 126496

Probe Type: 1"x1" NaI / (2"x2" NaI) (Shielded) / Not Shielded **Lift Elevation:** Surface to -3'

Background approx 1800 **cpm** **Action Level:** 7,819 **cpm**

Write grid designations in circles. Record highest counts for grid in cpm. Record 30 second counts at grid intersections (if required). Shade areas of elevated counts and record max cpm.



Attachment C

Gamma Spectroscopy Report

500-731 N. Grand Avenue DWM

Stan A. Huber Consultants, Inc.
200 N. Cedar Rd.
New Lenox, IL 60451

RSSI

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

Saturday, October 22, 2022

Glenn Huber glennhuber@sahci.com
Stan A. Huber Consultants, Inc.
200 North Cedar Road
New Lenox, Illinois 60451
USA

RE: DWM St Clair 101822

Mr. Huber:

A summary of gamma spectroscopy results for our sample number G220177 is in Table 1. Stan A. Huber Consultants, Inc. (SAHCI) identified the sample as DWM St Clair 101822. The table below lists the concentrations of radionuclides requested by SAHCI. Values with a less-than symbol ("<") indicate a concentration below RSSI's minimum detectable concentration (MDC). Other identified radionuclides are in the complete gamma spectroscopy report.

Table 1. High-resolution Gamma Spectroscopy Results [pCi/g]

Decay Series	Radionuclide	Sample ID
		G220177
		DWM St Clair 101822
Thorium (4n)	Ac-228	26.41
	Ra-228[1]	26.41
	Th-232[2]	26.41
	Ra-224	26.37
	Pb-212	25.29
	Bi-212	29.43
	Tl-208	8.10
Uranium (4n+2)	Th-234	< 0.61
	Pa-234m	10.79
	U-238[3]	< 5.70
	Ra-226[4]	0.84
	Pb-214	0.78
	Bi-214	0.81
Misc.	K-40	7.67

NOTES

[1] The concentration of Ra-228 is calculated from the concentration of its surrogate, Ac-228.

Analysis was performed at RSSI's laboratory in Morton Grove, Illinois, which is authorized by the 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. This analysis was performed under the scope of testing certificate L21-761 in accordance with the ASTM standard C1402-17.

ilac-MRA PJLA Testing Accreditation #101315

[2] The concentration of Th-232 is calculated from the concentration of its surrogate, Ac-228.
[3] The concentration of U-238 is calculated from the average of the concentrations of its surrogates, Th-234 and Pa-234m.
[4] The concentration of Ra-226 is calculated from the average of the concentrations of its surrogates, Pb-214 and Bi-214.

Some radionuclides of interest, radium-226 (Ra-226), radium-228 (Ra-228), thorium-232 (Th-232), and uranium-238 (U-238) are difficult to identify and quantify directly at low concentrations with reasonable counting intervals. The concentrations of surrogates with more abundant photons represent the concentrations of these radionuclides. The successful use of surrogates depends upon the radionuclides in each series being in equilibrium.

In the thorium series, actinium-228 (Ac-228) is usually in equilibrium with and is used as a surrogate for Ra-228 and Th-232. Bi-212 has a branching fraction of approximately 0.36 for decays to thallium-208 (Tl-208). Therefore, the activity of Tl-208 is approximately 36% the activity of other radionuclides in the thorium series. The branching fraction is the fraction of decays that proceed through a given decay path.

U-238, in the uranium series, emits photons with very low gamma fractions. In the uranium series, thorium-234 (Th-234) and Pa-234m are usually in equilibrium with U-238 when samples are collected and analyzed. The average of Th-234 and Pa-234m is used as the surrogate for U-238.

Ra-226, in the uranium series, has only one significant photon at 186.21 keV with a gamma fraction slightly greater than 0.03. Analysis for Ra-226 using this energy is difficult because of the possible presence of uranium-235 (U-235), which has an interfering 185.72 keV photon with a 0.57 gamma fraction, and protactinium-234 (Pa-234) which emits an interfering 186.15 keV photon with a 0.02 gamma fraction. The gamma fraction is the fraction of decays that produce a photon of a given energy. Bismuth-214 (Bi-214) and lead-214 (Pb-214) are used as surrogates for Ra-226.

The equilibrium between Ra-226 and its decay products, including Pb-214 and Bi-214, may be disturbed if radon-222 (Rn-222) is released when samples are collected or shipped. Rn-222, a gaseous Ra-226 decay product, has a half-life of 3.8 days. Pb-214 and Bi-214 reestablish equilibrium with Ra-226 in a sample after an in-growth period, typically seven Rn-222 half-lives. In standard protocols, samples are held for a 30-day in-growth period to reestablish equilibrium. This sample was analyzed on receipt and has not been held for an in-growth period of at least 30 days. The average of the concentration of Pb-214 and Bi-214 is shown as the concentration of Ra-226.

These samples were analyzed as received and the results shown have not been corrected for moisture content.

The complete spectroscopy analysis results are attached. Uncertainties are shown in the full results and are automatically calculated by the ORTEC GammaVision software based on the

peaks used. Additional details can be provided on request. Please call me at 847-965-1999 if you have any questions.

Sincerely,

Aaron D. Morris

Aaron Morris

Attachment

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
Spectrum name: G220177.An1

Sample description
G220177 Stan A. Huber Consultants, DWM St Clair 101822, 962.7 g

Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1

***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****

Nuclide		Activity uCi/g	Time of Count Uncertainty Counting	1 Sigma Total
AC-228		2.6407E-05	1.036E+00%	2.383E+00%
PB-214		8.4435E-07	1.296E+01%	1.319E+01%
BI-214		7.8140E-07	1.038E+01%	1.063E+01%
K-40		7.6725E-06	4.640E+00%	5.756E+00%
Th-234	<	6.0504E-07		
Pa-234m#		1.0785E-05	3.530E+01%	3.537E+01%
Pb-212		2.5286E-05	4.766E-01%	3.001E+00%
Bi-212		2.9430E-05	3.452E+00%	4.123E+00%
Tl-208		8.1012E-06	9.832E-01%	2.484E+00%
U-235	<	1.8177E-07		
Ra-224		2.6374E-05	5.780E+00%	6.491E+00%
Th-228		3.5074E-05	1.018E+01%	1.064E+01%
Cs-137	<	2.7111E-08		

- All peaks for activity calculation had bad shape.
* - Activity omitted from total
& - Activity omitted from total and all peaks had bad shape.
< - MDA value printed.
A - Activity printed, but activity < MDA.
B - Activity < MDA and failed test.
C - Area < Critical level.
F - Failed fraction or key line test.
H - Halflife limit exceeded

---------- S U M M A R Y ----------

Total Activity (1509.2 to 1755.9 keV) 1.708E-04 uCi/g
This section based on library: Tetra Tech - 2018-04.Lib

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
Spectrum name: G220177.An1

Sample description
G220177 Stan A. Huber Consultants, DWM St Clair 101822, 962.7 g

Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1

***** S U M M A R Y O F L I B R A R Y P E A K U S A G E *****

- Nuclide - Name	Code	Average Activity uCi/g	Peak Energy keV	Activity uCi/g	Code	MDA Value uCi/g	COMMENTS
AC-228	N	2.6407E-05					
			911.20	2.687E-05	(P	8.261E-08 1.03E+00	G
			968.97	2.645E-05	(P	1.654E-07 1.33E+00	G
			338.32	2.567E-05	(P	2.115E-07 1.65E+00	G
			964.77	2.538E-05	(	4.765E-07 2.84E+00	G
			463.00	2.485E-05	-	8.106E-07 4.11E+00	G
			93.35	3.706E-05	+	1.215E-06 3.00E+00	XA
			89.96	2.641E-05	}	2.222E-06 5.02E+00	XA
			1638.28	5.093E-05	+	5.722E-06 1.24E+01	GA
			1630.63	4.084E-05	+	2.655E-06 6.72E+00	G
			1588.19	4.880E-05	&	1.891E-06 4.15E+00	G
			1580.53	3.952E-05	+	4.713E-06 1.58E+01	GA
			1557.10	5.894E-05	+	1.253E-05 3.14E+01	GA
			1501.57	3.766E-05	+	5.510E-06 1.24E+01	GA
			1495.93	4.002E-05	+	3.712E-06 7.40E+00	GA
			1459.14	1.362E-05	- P	5.801E-06 3.95E+01	GA
			1110.61	5.782E-05	+	7.276E-06 1.70E+01	GA
			1065.19	7.253E-05	+	1.555E-05 2.84E+01	GA
			904.19	2.140E-05	-	3.016E-06 1.68E+01	GA
			840.38	2.435E-05	-	2.668E-06 1.52E+01	GA
			835.71	2.626E-05		1.737E-06 7.11E+00	GA
			830.49	3.412E-05	+	4.336E-06 1.63E+01	GA
			794.95	2.468E-05	-	9.463E-07 4.52E+00	G
			782.14	2.684E-05	P	5.321E-06 1.85E+01	GA
			772.29	2.081E-05	-	2.085E-06 1.88E+01	G
			755.32	3.336E-05	+ P	3.031E-06 1.36E+01	G
			562.50	2.834E-05	+	3.261E-06 1.55E+01	GA
			478.40	4.568E-05	+	1.012E-05 3.03E+01	GA
			409.46	2.293E-05	-	1.406E-06 1.44E+01	G
			328.00	2.664E-05	@(	7.317E-07 5.97E+00	G
			270.25	2.351E-05	-	8.890E-07 5.35E+00	G
			209.25	2.233E-05	-	8.004E-07 4.36E+00	G
			153.98	2.257E-05	-	3.448E-06 1.95E+01	GA
			129.06	1.977E-05	-	1.305E-06 9.77E+00	GA
			108.58	4.999E-05	+	9.772E-06 1.92E+01	XA
			105.60	5.415E-05	+ P	3.960E-06 6.98E+00	XA
			99.51	1.449E-05	- P	2.189E-06 1.46E+01	GA
PB-214	N	8.4435E-07					
			351.93	7.593E-07	(P	5.827E-08 1.54E+01	G
			295.22	9.869E-07	(P	9.240E-08 1.27E+01	G
			242.00	9.044E-07	(P	6.315E-07 6.70E+01	G
			258.87	0.000E+00	%	1.886E-06 1.25E+02	G
			785.96	0.000E+00		4.561E-08 0.00E+00	G
							Energy duplication
			77.11	0.000E+00		3.913E-09 0.00E+00	XA
							Energy duplication
			74.82	0.000E+00		7.160E-09 0.00E+00	XA
			89.78	0.000E+00		3.251E-08 0.00E+00	XA
BI-214	N	7.8140E-07					
			609.31	7.889E-07	(P	5.072E-08 9.89E+00	G
			1120.29	7.586E-07	(P	1.551E-07 3.67E+01	G
			1764.49	0.000E+00	=	0.000E+00 0.00E+00	G

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
Spectrum name: G220177.An1

Sample description
G220177 Stan A. Huber Consultants, DWM St Clair 101822, 962.7 g

Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1

			768.36	0.000E+00	% P	3.926E-07	1.00E+03	G	
			1238.11	1.354E-06	+ P	3.936E-07	3.29E+01	G	
			934.06	0.000E+00		1.876E-08	0.00E+00	G	
			1377.67	5.056E-06	& P	6.895E-07	2.14E+01	G	
			1729.60	0.000E+00		3.753E-08	0.00E+00	G	
			1509.23	1.817E-06	+	6.920E-07	4.12E+01	G	
			1407.98	0.000E+00		3.986E-08	0.00E+00	G	
			1401.50	0.000E+00		6.713E-08	0.00E+00	GA	
			1280.96	0.000E+00		5.408E-08	0.00E+00	GA	
			665.45	0.000E+00		2.905E-08	0.00E+00	GA	
			89.81	0.000E+00		9.808E-08	0.00E+00	XA	
			89.26	0.000E+00		1.899E-07	0.00E+00	XA	
K-40	N	7.6725E-06							
			1460.82	7.673E-06	(P	2.782E-07	3.88E+00	G	
Th-234	N	0.0000E+00							
			92.38	0.000E+00	%	6.050E-07	1.00E+03	G	
			92.80	0.000E+00	%	1.344E-06	1.00E+03	G	
			63.29	0.000E+00	&	1.835E-06	1.00E+03	G	
Pa-234m	N	1.0785E-05							
			1001.03	1.078E-05	&(P	2.011E-06	3.16E+01	G	
			98.43	0.000E+00	% P	1.076E-05	2.18E+03	XA	
Pb-212	N	2.5286E-05							
			238.63	2.532E-05	(P	5.865E-08	4.76E-01	G	
			300.09	2.480E-05	(	6.076E-07	5.00E+00	G	
			115.18	3.520E-05	+	4.128E-06	2.00E+01	G	
									Energy duplication
			77.11	1.906E-05	-	4.249E-07	2.00E+00	XA	
									Energy duplication
			74.82	2.497E-05	}	7.755E-07	1.87E+00	XA	
			87.35	2.529E-05	}	1.157E-06	2.33E+00	XA	
			86.83	1.376E-05	}	2.243E-06	1.28E+01	XA	
			89.78	2.529E-05	}	3.025E-06	8.98E+00	XA	
Bi-212	N	2.9430E-05							
			727.33	2.943E-05	(P	4.381E-07	3.44E+00	G	
			785.37	2.589E-05	-	2.547E-06	8.83E+00	G	
			288.20	4.104E-05	+ P	6.734E-06	2.35E+01	G	
			1620.50	4.250E-05	+	2.968E-06	9.74E+00	G	
Tl-208	N	8.1012E-06							
			583.19	8.101E-06	(	3.242E-08	9.83E-01	G	
			277.35	8.930E-06	+	4.316E-07	6.55E+00	G	
			860.56	9.353E-06	+	3.253E-07	3.44E+00	G	
									Energy duplication
			74.97	8.101E-06	}	2.260E-06	1.29E+01	XA	
			72.81	1.852E-05	+	3.477E-06	1.85E+01	XA	
U-235	N	0.0000E+00							
			143.76	0.000E+00	&	1.818E-07	1.00E+03	G	
			163.36	0.000E+00	%	3.359E-07	1.00E+03	G	
			205.31	0.000E+00	&	4.582E-07	1.00E+03	G	
			93.35	0.000E+00	%	3.494E-07	1.00E+03	XA	
			89.96	0.000E+00	%	5.724E-07	1.00E+03	XA	
Ra-224	N	2.6374E-05							
			240.99	2.637E-05	(P	1.486E-06	5.78E+00	G	

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
Spectrum name: G220177.An1

Sample description
G220177 Stan A. Huber Consultants, DWM St Clair 101822, 962.7 g

Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1

Th-228	N	3.5074E-05						
			84.37	3.377E-05	(	3.347E-06	1.02E+01	G
			215.98	4.133E-05	?(	1.048E-05	4.51E+01	G
			166.41	0.000E+00		1.521E-07	0.00E+00	G
Cs-137	I	0.0000E+00						
			661.66	0.000E+00	%	2.711E-08	1.00E+03	G

(- This peak used in the nuclide activity average.

* - Peak is too wide, but only one peak in library.
! - Peak is part of a multiplet and this area went
negative during deconvolution.
? - Peak is too narrow.
@ - Peak is too wide at FW25M, but ok at FWHM.
% - Peak fails sensitivity test.
$ - Peak identified, but first peak of this nuclide
failed one or more qualification tests.
+ - Peak activity higher than counting uncertainty range.
- - Peak activity lower than counting uncertainty range.
= - Peak outside analysis energy range.
& - Calculated peak centroid is not close enough to the
library energy centroid for positive identification.
P - Peakbackground subtraction
} - Peak is too close to another for the activity
to be found directly.

Nuclide Codes:	Peak Codes:
T - Thermal Neutron Activation	G - Gamma Ray
F - Fast Neutron Activation	X - X-Ray
I - Fission Product	P - Positron Decay
N - Naturally Occurring Isotope	S - Single-Escape
P - Photon Reaction	D - Double-Escape
C - Charged Particle Reaction	K - Key Line
M - No MDA Calculation	A - Not in Average
R - Coincidence Corrected	C - Coincidence Peak
H - Halflife limit exceeded	

- -
This section based on library: Tetra Tech - 2018-04.Lib

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
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Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1

********** U N I D E N T I F I E D P E A K S U M M A R Y **********

Peak Channel	Centroid Energy	Background Counts	Net Area Counts	Intensity Cts/Sec	Uncert 1 Sigma %	FWHM keV		Suspected Nuclide
125.81	25.06	6831.	5321.	1.478	3.40	1.192	-	s
220.77	45.54	8395.	397.	0.110	50.99	0.291	-	s
318.52	66.62	9583.	541.	0.150	38.62	0.456	-	sM
428.70	90.38	16487.	937.	0.260	19.66	1.664	-	D
631.20	134.06	7965.	254.	0.071	59.91	0.231	-	sM
685.33	145.73	8115.	238.	0.066	65.79	0.542	-	s
1169.96	250.26	4792.	463.	0.129	39.83	0.646	-	s
1420.53	304.31	1147.	57.	0.016	85.37	0.443	-	sc
1471.48	315.30	2199.	276.	0.077	33.76	0.495	-	s
2358.76	506.69	1775.	83.	0.023	72.85	1.763	-	sc
2377.79	510.79	2314.	5201.	1.445	1.91	1.765	-	D
2463.32	529.29	965.	90.	0.025	56.52	0.336	-	s
2653.37	570.30	1390.	204.	0.057	35.57	0.420	-	s
2689.66	578.13	725.	41.	0.011	98.17	0.439	-	sc
2748.51	590.83	547.	59.	0.016	60.87	0.306	-	s
3248.55	698.74	1253.	301.	0.084	27.78	0.404	-	s
4256.64	916.32	303.	84.	0.023	42.13	0.302	-	sM
4538.40	977.15	260.	61.	0.017	71.10	0.423	-	s
5897.69	1270.65	186.	73.	0.020	44.94	0.624	-	sM
6183.80	1332.43	84.	32.	0.009	52.66	0.504	-	s

s - Peak fails shape tests.
D - Peak area deconvoluted.
L - Peak written from unknown list.
C - Area < Critical level.
M - Peak is close to a library peak.

This section based on library: Tetra Tech - 2018-04.Lib

ORTEC g v - i (1215) Env32 G53W4.22 22-OCT-2022 12:44:59
Spectrum name: G220177.An1

Sample description
G220177 Stan A. Huber Consultants, DWM St Clair 101822, 962.7 g

Spectrum Filename: H:\GammaVision\User\Spectra\G220177.An1
Acquisition information
Start time: 22-Oct-2022 11:43:29
Live time: 3600
Real time: 3646
Dead time: 1.27 %
Detector ID: 3

Detector system
CLTCOMP MCB 9

Calibration
Filename: G220177.An1
2022-03-15 30% GEM-30185-P Calibration

Energy Calibration
Created: 22-Oct-2022 11:41:17
Zero offset: -2.066 keV
Gain: 0.216 keV/channel
Quadratic: 2.668E-08 keV/channel^2

Efficiency Calibration
Created: 15-Mar-2022 09:46:26
Type: Polynomial
Uncertainty: 1.176 %
Coefficients: -0.632209 -4.051028 0.362236
-0.031189 0.000476 -0.000003

Library Files
Main analysis library: Tetra Tech - 2018-04.Lib
Library Match Width: 0.500
Peak stripping: Library based

Analysis parameters
Analysis engine: Env32 G53W4.22
Start channel: 20 (2.25keV)
Stop channel: 8144 (1755.88keV)
Peak rejection level: 100.000%
Peak search sensitivity: 3
Sample Size: 9.6270E+02
Activity scaling factor: 1.0000E+00/(1.0000E+00* 9.6270E+02) =
1.0387E-03
Detection limit method: Traditional ORTEC method
Random error: 1.0000000E+00
Systematic error: 1.0000000E+00
Fraction Limit: 0.000%
Background width: best method (based on spectrum).
Half lives decay limit: 12.000
Activity range factor: 2.000
Min. step backg. energy 0.000
Multiplet shift channel 2.000

Corrections	Status	Comments
Decay correct to date:	NO	
Decay during acquisition:	NO	
Decay during collection:	NO	
True coincidence correction:	NO	
Peaked background correction:	YES	2022-03-08 Background.Pbc 10-Mar-2022 11:36:47
Absorption (Internal):	NO	
Geometry correction:	NO	
Random summing:	NO	

total peaks alloc. 79 cutoff 20.00000 %
Energy Calibration
Normalized diff: 0.1166

RSSI

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

The analytical results above relate only to the sample(s) provided to RSSI by the client. The condition of the sample(s) as provided to the laboratory, unless otherwise specified, is the condition of the sample(s) during analysis. Unless otherwise specified, analysis was performed at RSSI.

Analysis authorized by license No. IL-01429-01. Analysis approved by the Canadian Nuclear Safety Commission, meeting the criteria and requirements of R-116.

The identification of the sample(s) and/or sample material(s) is based on information as provided by the client.

-- End Report --

Attachment D

Radiation Survey Form – Removable Contamination

500-731 N. Grand Avenue DWM

Stan A. Huber Consultants, Inc.
200 N. Cedar Rd.
New Lenox, IL 60451

RADIATION SURVEY FORM

Former Carnotite Reduction Company Site Remediation

SURVEY REFERENCE #: **001-101822-01**

DATE OF SURVEY: **10/18/2022**

NAME OF SURVEYOR: **Glenn Huber**

SURVEY METER IDENTIFICATION

Background Dose Rate: **60** cpm

Manufacturer: **Ludlum**

Model: **3 with 44-9 G-M Pancake**

Serial #: **154125**

REMOVABLE ANALYSIS INSTRUMENT ID

Efficiency: **34.5** % α **24.1** % β

MDA: **6.68** dpm α **69.44** dpm β

BKG: **0.16** cpm α **42.02** cpm β

Background Count Time: **50** min

Manufacturer: **Ludlum**

Model: **2929 (scaler) / 43-10-1 (alpha/beta)**

Serial #: **147753 / PR354629**

Sample Count Time: **2** min

Description (attached sketch if needed) (equipment, vehicle, materials, etc.)	Smear ID #:	Direct Survey Gross cpm	Removable Alpha Gross Counts	Removable Beta Gross Counts	Removable Alpha dpm/100cm^2	Removable Beta dpm/100cm^2
DWM Excavator Bucket						
Bucket Inside / Outside	**1**	**<100**	**1**	**96**	**<6.68**	**<69.44**