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Geosyntec consultants

1420 Kensington Road, Suite 103
Oak Brook, Illinois 60523
PH 630.203.3340
FAX 630.203.3341
www.geosyntec.com

31 July 2013

Mr. Ronald Palmieri, P.E.
GEI Consultants, Inc.
115 Lake Street, Suite 202
Libertyville, IL 60048

Subject: **Summary Report for the Right-of-Way Radiological Survey of the Northwestern Memorial Hospital Outpatient Care Pavilion Adjacent to 240 East Ontario Street, Chicago, IL – Geosyntec Consultants Project No. CHR8370**

Dear Mr. Palmieri:

Geosyntec Consultants has completed the above-referenced radiological survey. The attached summary report describes the work completed and presents our findings and conclusions. The work was completed in the right-of-way adjacent to the 240 East Ontario Street property. No soil or other materials were identified that exceeded the U.S. Environmental Protection Agency (USEPA) specified clean-up level of 7.1 pCi/g total radium based on the surveys conducted. No materials were excavated for disposal due to elevated radioactivity.

This survey work was performed as a permit requirement for USEPA, Chicago Department of Public Health, and Chicago Department of Transportation, permit number D11291-01. Copies of this report will be forwarded to the attention of the following contact persons:

USEPA – Eugene Jablonowski

Chicago Department of Public Health – Ms. Rahmat Begum

We have appreciated the opportunity to assist you and your client with this very interesting project. Please contact us with any questions you have regarding this report.

Sincerely,

J. Neil Couch
Project Manager

INTRODUCTION

Geosyntec Consultants (Geosyntec) has completed a radiological survey of the Northwestern Memorial Hospital Outpatient Care Pavilion Site, 240 East Ontario Street and 259 East Erie Street, Chicago, IL (the Site) in accordance with our proposal dated 12 September 2011, and scope changes dated March 30, 2012. This work was conducted under contract to GEI Consultants Inc. (GEI) on behalf of Northwestern Memorial Hospital. A summary report of these surveys was submitted to GEI 4 June 2012. As part of the original scope of work additional right-of-way excavations were required to facilitate the installation of water and sewer utilities to the subject properties. The radiological surveys associated with these right-of-way excavations are summarized within this summary report.

An area of the Streeterville neighborhood of Chicago has been identified as potentially impacted by radioactive materials as a result of the former use of thorium in industrial operations by the Lindsay Light and Chemical Company (Lindsay Light) from the early 1900s through mid-1930s. USEPA, the Chicago Department of Health, and the Chicago Department of Transportation have established a moratorium area encompassing a portion of the Streeterville neighborhood within which any excavation is required to be surveyed for elevated radioactivity. The subject Site is located along the northern limits of that moratorium area; the northern limit of the area is East Ontario Street and includes any properties located along the north side of East Ontario Street. The USEPA requested radiological surveys of excavations that fall within the lateral boundary of the 240 East Ontario Street property. The ROW surveys were conducted to satisfy these Agency requirements.

The purpose of this summary report is to discuss the completed surveys. The surveys were conducted for the following purposes:

- Protect the workers on the Site who could come in contact with radiologically impacted material.
- Protect nearby residents from exposure due to tracking of radiologically impacted material off Site or exposure due to fugitive dust from the Site.
- Assure that radiologically impacted soil (if identified) is properly managed from staging through transport and disposal at a permitted disposal facility.

USEPA has established the clean-up threshold for the Streeterville neighborhood at 5 picoCuries per gram (pCi/g) total radium (Ra-226 + Ra-228) above background. The background activity has been measured by USEPA at 2.1 pCi/g total radium. As such, the clean-up threshold for the Site and vicinity is 7.1 pCi/g total radium.

Thorium contamination in the Streeterville neighborhood has generally been limited to fill materials when present. The native sand and clay soil beneath the urban fill soil is not impacted by the contamination from the Lindsay Light operations. USEPA has allowed that if the overlying fill soils are not impacted, underlying native sand and clay soil does not require surveying. Accordingly, a survey was not conducted on underlying sands or soils where the fill materials above the native sands were not found to be contaminated.

SCOPE OF WORK

The scope of work included surveying several utility corridor excavations as they were being excavated in the right-of-way along East Ontario Street adjacent to the 240 East Ontario Street parcel (**see Figure 1**). Excavations were completed at night to minimize traffic disruption and building construction from 21 September 2012 to 7 November 2012.

Geosyntec subcontracted the field survey portion of the work to Stan A. Huber Consultants, Inc. (Huber Consultants). Gamma surveys were performed by a licensed Health Physicist-Site Radiation Technician, using an unshielded Ludlum Model 2221 Scaler/Ratemeter (serial #126497) with a 2" x 2" NaI probe provided by Huber Consultants. The Ludlum survey instrument is calibrated annually using Illinois Emergency Management Agency (IEMA) – Division of Nuclear Safety calibration blocks. The annual calibration procedure has been approved by both the IEMA and USEPA as an acceptable method of calibrating survey instruments to the 7.1 pCi/g clean-up threshold. The USEPA threshold count level indicating 7.1 pCi/g total radium, for the specific instrument used at this site (serial #126497), was equivalent to 19,386 counts per minute (cpm). The calibration procedure and instrument calibration certification is provided in **Appendix A**.

The surveys were performed by the radiation technician scanning the entire exposed surface of the surveyed area with the probe approximately 1-2 inches above the soil surface. The readings recorded were the maximum readings for each of the surveyed areas at the ground surface and for each 18 inch lift as the areas were excavated.

The utility corridor excavations were conducted from the south side of the East Ontario street and continuing north across East Ontario Street and the temporary sidewalk

immediately south of the site. **Figure 1** shows the utility corridors excavated and surveyed to facilitate the installation of the new utilities. The excavated areas were subdivided into smaller grid sections as the excavation progressed across East Ontario Street. None of the readings were above the USEPA established clean-up criteria. The maximum gamma reading within each grid was recorded in 18 inch increments with depth (**see Table 1**). The readings ranged from 5,800 to 10,600 cpm, which were below the threshold criteria of 19,386 cpm.

CONCLUSIONS

All utility excavations associated with construction on the 240 East Ontario parcel were surveyed in accordance with the Work Plan. No materials exceeding the cleanup threshold established by USEPA were identified during the utility surveys in the right-or-way. As such, no materials were removed from the Site for disposal as a result of elevated radioactivity.

TABLE

Table 1 Utility Corridor Gamma Survey Results

Adjacent to 240 East Ontario Street

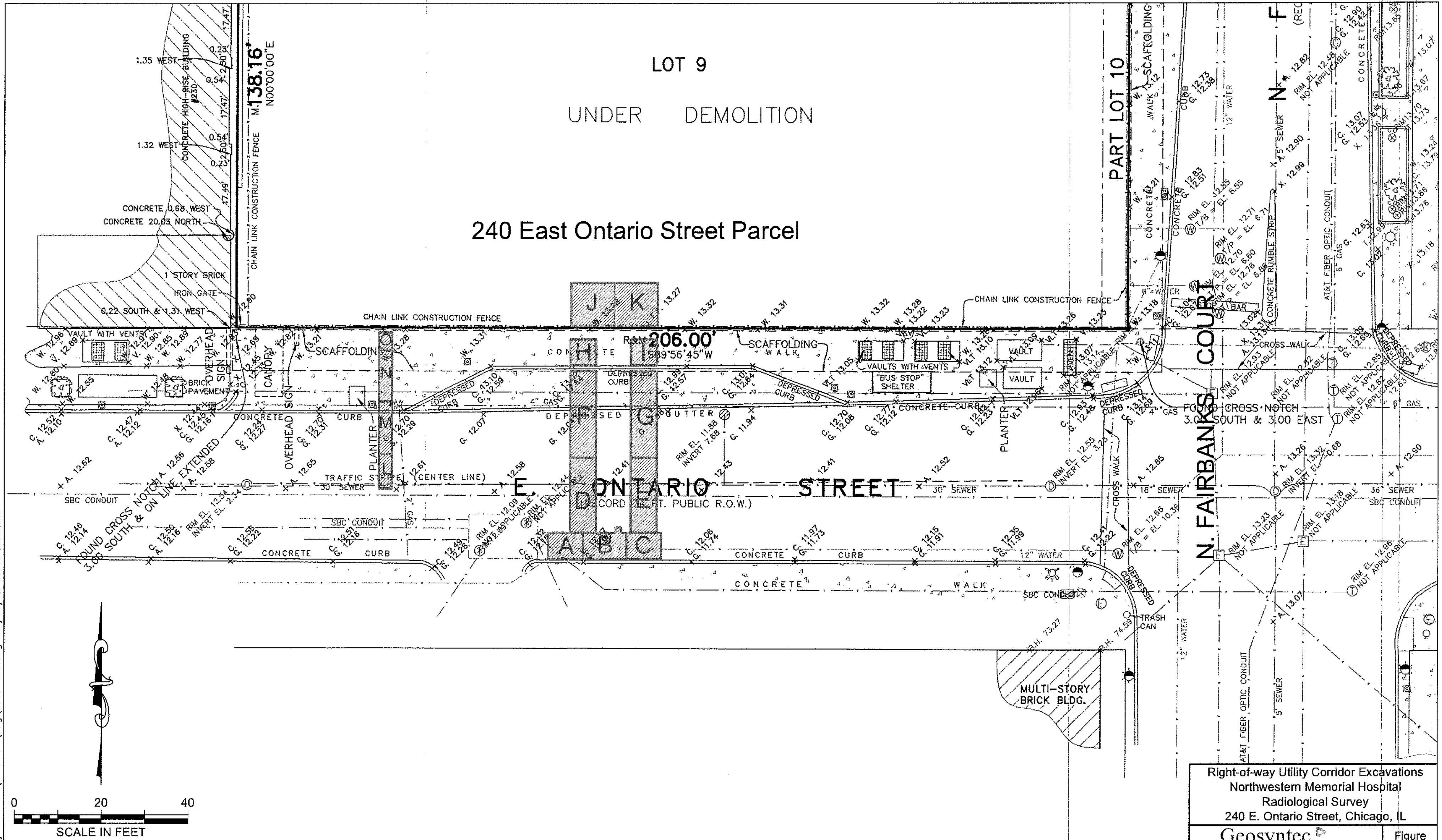
Grid	Depth (feet)	Counts per Minute (cpm)
A	surface	6,500
	-1.5	7,100
	-3.0	7,000
	-4.5	8,200
	-6.0	8,700
B	surface	6,700
	-1.5	7,400
	-3.0	7,800
	-4.5	8,400
	-6.0	8,700
C	surface	6,400
	-1.5	7,300
	-3.0	6,900
	-4.5	7,800
	-6.0	8,400
	-7.0	8,300
D	surface	6,400
	-1.5	9,100
	-3.0	10,600
	-4.5	8,900
	-6.0	9,400
	-6.5	9,900
E	surface	7,200
	-1.5	8,100
	-3.0	6,900
	-4.5	7,500
	-6.0	9,800
	-7.0	10,400
F	surface	5,900
	-1.5	6,300
	-3.0	7,700
	-4.5	7,900
	-6.0	8,100
	-6.5	8,300
G	surface	6,100
	-1.5	7,100
	-3.0	7,600
	-4.5	8,100
	-6.0	8,400
	-7.5	9,100
H	surface	5,800
	-1.5	6,100
	-3.0	7,800
	-4.5	8,400
	-6.0	8,100
	-7.5	8,700

Grid	Depth (feet)	Counts per Minute (cpm)
I	surface	5,900
	-1.5	6,900
	-3.0	7,400
	-4.5	8,700
	-6.0	7,900
	-7.5	8,100
J	surface	5,900
	-1.5	6,900
	-3.0	8,400
	-4.5	8,700
	-6.0	9,400
	-7.5	8,900
	-9.0	8,100
K	surface	6,200
	-1.5	7,600
	-3.0	8,200
	-4.5	7,300
	-6.0	6,700
	-7.5	8,100
	-9.0	7,600
L	surface	5,900
	-1.5	6,900
	-3.0	7,300
	-4.5	6,400
	-6.0	7,900
	-7.5	8,200
M	surface	6,200
	-1.5	7,000
	-3.0	7,100
	-4.5	7,200
	-6.0	6,700
	-7.5	8,700
N	surface	9,100
	-1.5	8,700
	-3.0	10,100
	-4.5	8,700
	-6.0	9,500
	-7.5	9,700
O	surface	8,700
	-1.5	9,100
	-3.0	10,300
	-4.5	9,700
	-6.0	9,800
	-7.5	10,100

Notes:

1) Cleanup threshold of 7.1pCi/g is 19,368 cpm for the instrument used in the surveys.

FIGURE



Base Map Obtained from Chicago Guarantee Survey Company
Drawing of Northwestern Memorial Hospital Order # 2010-13997-001

Right-of-way Utility Corridor Excavations
Northwestern Memorial Hospital
Radiological Survey
240 E. Ontario Street, Chicago, IL

Geosyntec consultants

CHR8370		Figure
Oak Brook, IL	05 Dec 2012	1

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APPENDIX A

Calibration Certificate and Procedure

Ludlum Model 2221/44-10 Calibration

Model 2221 serial number: 126497

Probe 44-10 serial number: PR171991

Date: 1/8/11

Scaler Linear Check

Pulser model/serial number: Ludlum 500 1 # 159107

Calibration Due Date: 1/27/12

Threshold set to 100 mv. _____ (tech. init.)

Pulser setting in cts.	Multiplyer	As Found Scaler reading in cts.	After Adjustment Scaler reading in cts.
400	X1	400	—
4k	X10	4001	—
40k	X100	40014	—
400k	X1000	400025	—

Voltage Plateau

Source isotope/serial number: Cs-137 0.89uC on Ludlum 1 # 4830

BKGD PLATEAU volts	BKGD PLATEAU counts (source / Bkg counts)	SOURCE PLATEAU volts	SOURCE PLATEAU counts (source / Bkg counts)
700	3326	1100	30321 4084
750	28393 3656	1150	31069 4233
800	29443 3822	1200	34840 4752
850	29702 4026		
900	30144 4057		
950	30438 3934		
1000	30492 4089		
1050	30208 4171		

operating voltage selected: 1000V

w/ 6" shield

Ludlum Model 2221/44-10 Calibration

Model 2221 serial number: 126497

Probe 44-10 serial number: PR171991

Date: 11/8/11 ☒ window verified at about 3830

Instrument BKGD

1 minute BKDG counts

1794	1689
1739	1678
1697	1697

Average: 1716

Source Block Data

Source block ID: 2012 - 5417A, 2012 - 5407A, 2012 - 5437A, 2012 - 5447A

1 minute Source Block counts

8384	8427
8547	8538
8675	8408

Average: 8497 cpm Net Average: 6781 cpm

Activity Calculation

Net Average source count rate of: 6781 cpm divided by 10 = 678.1

Times ~~7.2~~ 7.1 = 4814.5 (A)

Square root of (A) = 69.4 times 2 = 138.8 (B)

(A) plus the average BKGD = 6530.5 CPM/~~7.2~~ 7.1 pCi

The cutoff value is: 6392 (CPM/~~7.2~~ 7.1 pCi minus (B))

6" shielded

Calibration performed by: [signature] DATE: 11/8/11

Calibration approved by: _____ DATE: _____

Unshielded

Ludlum Model 2221/44-10 Calibration

Model 2221 serial number: 126497

Probe 44-10 serial number: PR171991

Date: 11/8/11 ☒ window verified at about 3830

Instrument BKGD

1 minute BKDG counts

6618	6566
6487	6315
6425	6558

Average: 6495

Source Block Data

Source block ID: 2012-5417A, 2012-5418A, 2012-5419A, 2012-5420A

1 minute Source Block counts

24906	25090
24751	25044
25047	24850

Average: 24948 cpm Net Average: 18453 cpm

Activity Calculation

Net Average source count rate of: 18453 cpm divided by 10 = 1845.3

Times ~~7.2~~ 7.1 = 13101.6 (A)

Square root of (A) = 114.5 times 2 = 229.0 (B)

(A) plus the average BKGD = 19596.6 CPM/~~7.2~~ 7.1 pCi

The cutoff value is: ~~19336~~ 19368 (CPM/~~7.2~~ 7.1 pCi minus (B))

Unshielded

Calibration performed by: [signature] DATE: 11/8/11

Calibration approved by: _____ DATE: _____

CALIBRATION OF 2221 WITH 44-10 FOR SURFACE SCANNING

WORK INSTRUCTION

1. Record the instrument and detector serial numbers on attachment 3.
2. Perform a scaler linear check as follows:
   - 2.1 Record the pulser model/serial number on attachment 3
   - 2.2 Record the calibration due date on attachment 3
   - 2.3 Check the threshold setting to insure that it is set at 100mv, if it is not set at 100mv then adjust it in accordance with section 5. .
   - 2.4 Connect the pulser to the instrument.
   - 2.5 Send 400,4000.40K and 400K cpm pulses into the meter
   - 2.6 Record the meter responses in the "AS FOUND"column of attachment 3.
   - 2.7 If the meter does not indicate the correct response to within ± 10% perform the following steps as necessary:
     - 2.7.1 Send 400 cpm pulses into the meter and adjust the reading for an acceptable reading
     - 2.7.2 Send 4000 cpm pulses into the meter and adjust the reading for an acceptable reading
     - 2.7.3 Send 40k cpm pulses into the meter and adjust the reading for an acceptable reading
     - 2.7.4 Send 400k cpm pulses into the meter and adjust the reading for an acceptable reading
     - 2.7.5 Record the resulting readings in the after adjustment column on attachment 3
     - 2.7.6 If unable to adjust to within ± 10% , place the instrument out of service for repair.

1.3 PERFORM A VOLTAGE AND BACKGROUND AS FOLLOWS:

- 1.3.1 Record the source isotope and serial number on attachment 3.
- 1.3.2 Perform a source plateau by exposing the detector to a radioactive source and recording the meter reading at 50 volt increases until a plateau is developed. record the voltage and the meter reading for each increment on attachment 3.
- 1.3.3 At selected voltage increments perform a background reading and record the meter reading on attachment 3 .
  - 1.3.3.1 Set the meter high voltage to between 1/3 and 1/2 of the voltage plateau.
  - 1.3.3.2 Record the selected high voltage setting on attachment 3.

1.4 INSTRUMENT BACKGROUND

- 1.4.1 Perform an instrument ***background*** as follows:
  - 1.4.1.1 Using the four background blocks, perform six - one minute counts (with the instrument set at the selected voltage) and set in the scaler mode.
  - 1.4.1.2 Record these readings on attachment 3
  - 1.4.1.3 Average the six readings and record the result on attachment 3.

1.5 CALIBRATION SOURCE BLOCK DATA

- 1.5.1 Record the source block serial number on attachment 3
- 1.5.2 Perform six one minute source block counts
- 1.5.3 Record the results on attachment 3
- 1.5.4 Average the source block cpm and record the result on attachment 3
- 1.5.5 Subtract the average background (recorded on attachment 3) from the average source block cpm .

1.6 ACTIVITY CALCULATION

1.6.1 Perform the calculation on attachment 3 to determine the activity cutoff value for 7.2 pCi/g.

1.6.2 Sign attachment 3

1.7 CALIBRATION STICKER

1.7.1 Complete the information required on attachment 4 and attach it to the side of the instrument.