AECOM
100 S. Wacker Drive, Suite 500
Chicago, Illinois 60606

312-939-1000 tel
312-939-4198 fax

November 20, 2017

Anton Collins
Powers Construction
8750 W. Bryn Mawr Ave., Suite 500
Chicago, Illinois 60631

RE: Radiological Survey of Electrical Utilities Installation
Permit No.: DOT800593 & DOT805638
Permit Address: 465 N. Park Ave., Chicago, Illinois
AECOM Project No. 60508241

Dear Mr. Collins:

Pursuant to conditions specified in a permit (see attached) issued by the City of Chicago Department of Public Health (CDPH), radiation monitoring was required to be performed at the above referenced site. AECOM Technical Services, Inc. (AECOM) provided the required radiation surveillance on May 31 through June 16, 2017 for an installation of an electrical conduit. Survey results were collected from within the trench as long as it could be safely entered, while at deeper depths the spoil from the trench was surveyed as it was excavated.

Surveying was performed within the excavation and on the spoil removed in the E. Illinois ROW at 465 N. Park Ave. (refer to Drawing). The excavation involved removal of concrete and additional trench excavations. Powers Construction sub-contractor (Meade) removed approximately 260-feet of concrete sidewalk and roadway. The trench excavation within the removed concrete areas was approximately 5 to 7-feet wide, to a depth of 4 to 7-feet below ground surface (bgs).

The U.S. Environmental Protection Agency (USEPA) removal action level for Chicago's Streeterville area is 7.1 picocuries per gram (pCi/g) total radium (Ra-226 + Ra-228). Gamma radiation count measurements for the project were made using a Ludlum Model 2221 survey meter and a shielded 2 x 2 inch sodium iodide (Nal) probe Model 44-10. For the instrument used, the gamma count indicative of the USEPA removal action level of 7.1 pCi/g was 17,193 counts per minute (cpm) unshielded and 7,097 cpm shielded. The field instrument gamma background for the area was measured at approximately 6,901 cpm unshielded. Field gamma measurements greater than twice the field background represent potential anomalous results that require more cautious and frequent field screening, but are not necessarily indications of the presence of thorium contaminated fill soil. Gamma readings above 17,193 unshielded or 7,097 shielded cpm could be considered a potential indication of the presence of radiologically contaminated fill.

With the exception of June 13, 2017, the gamma surveying between May 31 and June16, 2017, for the trench excavation work did not indicate the potential presence of radiological contamination (refer to Annotated Drawing and Tabulated Results). However, on June 13, 2017, AECOM identified elevated gamma readings above the instrument threshold equivalent to the removal action level established by the USEPA. The readings were identified during the trench excavation, approximately 23-feet north of the southern curb of E. Illinois St. and approximately 45-feet west of the intersection of E. Illinois St. and N. New St (refer to Annotated Drawing). The elevated readings were initially identified at approximately 24-inches bgs, ranging between 7,000 to 44,000 cpm shielded. The excavation activities were halted in the area of elevated gamma readings and USEPA was notified. A sample was collected from the area with the highest gamma readings and delivered for analysis to RSSI Laboratories (refer to Gamma Spec. Results). After the sample was collected the excavation area was covered with plastic sheeting and clean on-site gravel. The trench was covered with steel plates prior to departure at the end of the work day. The sample collected (465-CET) yielded results for radium-226 of 7.26 pCi/g and radium-228 of 82.16 pCi/g, with a total radium activity (Ra-226 + Ra-228) of 89.42 pCi/g, which is above the USEPA removal action level of 7.1 pCi/g.

After discussion with the USEPA, the remediation excavation activities for radiologically-contaminated fill were initiated on June 15, 2017. The goal of the remediation activities was to complete the excavation to the depth necessary for the conduit installation. Andrew Kozak (AECOM) was present on-site to monitor and lead the remediation activities, while air monitoring and work within the exclusion zone was conducted by health physicist Glenn Huber (Stan A. Huber Consultants). Based on the readings collected during the remediation excavations the contamination was identified at approximately 24 to 48-inches bgs and predominantly along the north side of the trench excavation. Shielded gamma readings of the contaminated zone ranged between 7,000 to 44,000 cpm. Gamma readings decreased below the unit cut-off value after the excavation activities reached the depth of approximately 4-feet bgs. Additionally, a 1-ft^2 area on the north wall was identified with elevated readings. This area was at approximately 36-inches bgs and was removed using a shovel by the health physicist in order to get the field gamma readings below the USEPA removal action level threshold.

Approximately 1.5 to 2 cubic yards (3,120 pounds) of contaminated fill were removed from the excavation site and placed in a bulk storage bag during the remediation operations. A composite sample of the fill remediated was collected and submitted for analysis (refer to attached gamma spec results). The bulk storage bag was closed and placed along the west side of the property boundary (N. Park Ave.) within the fenced construction site area to await completion of additional utility work. The bag was wrapped in plastic sheeting and labeled orange snow fencing. The remaining utility work was completed by AT&T in on November 10, 2017. Therefore, the bulk storage bag was shipped on November 14, 2017 by truck to US Ecology in Grand View, Idaho. A copy of the manifest/disposal information will be included within the Completion Report for the Site. Table 1 summarizes bag weights, sample results (as received basis) and bag exterior dose rates.

Table 1
465 N. Park St.

Bag #	Weight (lbs)	Total Radium (pCi/g) (Ra-226 + Ra-228)	Bag Exterior Max. Dose Rate (urem/hr)
465-CET-1	3,120	17.65	9

Excavating equipment used in the excavation of radiologically-contaminated fill was surveyed (released) to confirm the equipment was free of radiological contaminants prior to being released from the excavation project. Similarly, the exterior of the bulk storage bags were wiped to confirm the absence of contamination. Air monitoring was also conducted during the limited removal activities. A copy of the air monitoring and release results are included within the attachments (refer to Health Physics Results).

The USEPA was present on June 15, 2017, to collect a verification sample from the base of the excavation following the completion of the remediation and excavation activities. The results of the USEPA sample indicated a total radium activity of 0.98 pCi/g (refer to USEPA Analytical Results), which is well below the USEPA removal action level of 7.1 pCi/g. A sample from the north wall of the excavation was also collected by the USEPA to document the activity remaining in the wall. Results for this sample indicated a total radium activity of 13.58 pCi/g, which is above the USEPA removal action level. Although field gamma screening did not reveal elevated gamma readings on the north wall, it was not the intent of the remediation work to chase contaminated fill beyond the permitted limits of the trench excavation. After the remediation and sample collection by the USEPA the north wall of the excavation was covered with plastic sheeting to eliminate direct contact with the sidewall so that conduit installation was able to be completed.

In summary, the presence of radiologically-contaminated fill was discovered in a small section of the trench excavations completed within the E. Illinois St. ROW. The contaminated fill discovered during the excavation was remediated under the supervision of the USEPA within the trench to allow completion of the conduit installation. Sample results collected by the USEPA after the remediation indicated the base of the trench was completed, but that the north wall of the remediated trench section still likely contains some pockets of elevated radium. This report contains the gamma surrey results for the trench excavation as well as the supporting documentation collected during the trench remediation activities.

As part of the permit conditions, this letter has been forwarded to:

Chicago Department of Public Health
Attention: Mr. Terry Sheahan
333 South State Street, Room 200
Chicago, Illinois 60604

Please contact us with any questions you have regarding this letter or the reported results.

Regards,

Andrew Kozak
Geologist

Steven C. Kornder, Ph.D.
Senior Project Geochemist

cc: Terry Sheahan, Chicago Department of Public Health
Verneta Simon, USEPA

Attachments: CDPH Permit
Annotated Drawing and Tabulated Results
Gamma Spec. Results
USEPA Analytical Results
Health Physics Results

PERMIT

DEPARTMENT OF PUBLIC HEALTH

CITY OF CHICAGO

(STREETERVILLE Right-of-Way)

Notice is hereby given that the site you have requested a permit for is recorded with the City of Chicago Department of Public Health (CDPH) as potentially having environmental contamination on the site and adjacent right-of-way. This environmental contamination could present a threat to human health and safety in connection with work performed at the site, or in the adjacent right-of-way, if proper safeguards are not employed.

A file containing detailed information regarding the aforementioned environmental contamination is available for review at CDPH at 333 S. State St., Room 200, Chicago, Illinois 60604 during normal business hours (8:30AM-4:30PM, Monday through Friday). Contact (312) 745-3152 for an appointment. This file must be reviewed and the remainder of this form completed before the permit can be issued if the ground is exposed or excavated. **Please note that for some locations, additional health and safety procedures may be required by law.**

Please complete the following

I have reviewed and understand the documents, maintained by CDPH, regarding environmental contamination of the site and adjacent right-of-way. Further, I will ensure that all work at the subject site and adjacent right-of-way, and any monitoring required including but not limited to radiation monitoring, will be performed in a manner that is protective of human health and the environment and in compliance with all applicable local, state, and federal laws, rules, and regulations, especially those pertaining to worker safety and waste management. I will ensure that the results of any radiation monitoring and/or surveying conducted shall be provided to the CDPH and the United States Environmental Protection Agency within two (2) weeks of their completion. If any elevated levels of radioactive material are detected, I will immediately contact the United States Environmental Protection Agency at (800) 424-8802.

Applicant Name (print) CARMINE MATTOZZI Signature: Carmine Mattozzi

Site Address and Work Location (Describe exact site location and attach map) 465 N. Park Drive

Nature of Work: ComEd conduit installation

Company Name, Address, Phone No.: Power Construction 8750 W. Bryn Mawr, Ave Suite 500, 847-812-5146

General / Prime Contractor Name, Address, Phone No. Power Construction: Same as above "

Include subcontractor information if applicable)

Safety Officer / Phone No. Kody Molitor 630-201-6082

Radiation Contractor / Phone No. and email address (if applicable) AECOM Steve Kowalczyk 262-515-7700

Check if City Department Work ☐ Department Name:

CDOT Permit No.: DOT800593 & DOT805638

Today's Date: 5/24/17 Expected Start Date: 5/30/17 CDPH Approval / Date Terry Sheahan Digitally signed by Terry Sheahan DN: cn=Terry Sheahan, o=Chicago Department of Public Health, ou=Permitting and Inspections, email=terry.sheahan@cityofchicago.org, c=US Date: 2017.05.25 11:01:35 -05'00'

Please return this completed form to the Chicago Department of Transportation, Division of Infrastructure Management, Public Way Permit Office, City Hall – Room 905, 121 N. LaSalle St., Chicago, Illinois 60602 during normal business hours (8:30 AM - 4:30 PM, Monday through Friday)

For CDPH Use Only

RM-01

CE-ST-828

OUC#2017-75356

LEGEND

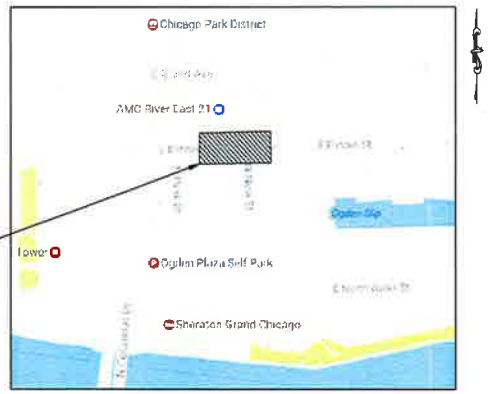
PROPOSED TRENCHED CONDUIT	
EXISTING CTA MANHOLE	CTA
EXISTING COMMUNICATION MANHOLE	COM
EXISTING RCN MANHOLE	R
EXISTING SEWER CATCH BASIN	
EXISTING SEWER INLET	
EXISTING SBC MANHOLE	
EXISTING SEWER MANHOLE	
EXISTING COMED MANHOLE	
EXISTING TRAFFIC LIGHT CONTROL BOX	
EXISTING ELECTRIC MANHOLE	
EXISTING WATER VALVE	
EXISTING GAS VALVE VAULT	
EXISTING GAS VALVE	
EXISTING MCI MANHOLE	
EXISTING COMCAST MANHOLE	
EXISTING CATV MANHOLE	C
EXISTING UTILITY POLE	
EXISTING SUPPORT / COLUMN	
EXISTING FIRE HYDRANT	
EXISTING PARKING PAYBOX	
EXISTING STREET LIGHT	
EXISTING STREET SIGN	
EXISTING TRAFFIC/LIGHT POLE	
EXISTING STREET LIGHT CONTROL BOX	
EXISTING MAILBOX	
EXISTING TREE	
APPROXIMATE PROPERTY LINE	
EXISTING FENCE	— x — x —
EXISTING CONSTRUCTION FENCE	— [] — [] —
EXISTING SEWER	— (— (—
EXISTING ELECTRIC	— E — E —
EXISTING WATER	— W — W —
EXISTING GAS	— G — G —
EXISTING DEAD GAS	— G — G —
EXISTING SBC	— SBC — SBC —
EXISTING COMED	— CE — CE —
EXISTING COMCAST	— CM — CM —
EXISTING RCN	— RCN — RCN —

121 NORTH LASALLE STREET, ROOM 905
CHICAGO, IL 60602

ComEd
An Exelon Company

COMED DISTRIBUTION CONDUIT INSTALLATION 319-342 E. ILLINOIS ST. FOR 465 N. PARK DR. CHICAGO, ILLINOIS W.O. #14017522

SITE LOCATION MAP



SHEET INDEX

DRAWING NO.	SHEET	DESCRIPTION	ISSUE PURPOSE	REV
RM-01	01	TITLE, LOCATION MAP, LEGEND, SHEET INDEX	ISSUED FOR CONSTRUCTION	A2
UIC-01	02	GENERAL CONSTRUCTION NOTES	ISSUED FOR CONSTRUCTION	A1
UIC-02	03	PLAN AND PROFILE	ISSUED FOR CONSTRUCTION	A1
UIC-03	04	RESTORATION PLAN	ISSUED FOR CONSTRUCTION	A2
UIC-04	05	DETAILS	ISSUED FOR CONSTRUCTION	A1
UIC-05	06	TRENCH SHORING DETAILS	ISSUED FOR CONSTRUCTION	A1
TCP-01	07	TRAFFIC CONTROL PLAN 1	ISSUED FOR CONSTRUCTION	A1
TCP-02	08	TRAFFIC CONTROL PLAN 2	ISSUED FOR CONSTRUCTION	A1
TCP-03	09	TRAFFIC CONTROL PLAN 3	ISSUED FOR CONSTRUCTION	A1
S1	10	6'-ABOVE GRADE-STRONG AXIS	ISSUED FOR CONSTRUCTION	A1
S2	11	6'-ABOVE GRADE-STRONG AXIS	ISSUED FOR CONSTRUCTION	A1
S3	12	6'-BELOW GRADE-STRONG AXIS	ISSUED FOR CONSTRUCTION	A1
S4	13	6'-BELOW GRADE-STRONG AXIS	ISSUED FOR CONSTRUCTION	A1
S5	14	6'-BELOW GRADE-WEAK AXIS	ISSUED FOR CONSTRUCTION	A1
S6	15	6'-BELOW GRADE-WEAK AXIS	ISSUED FOR CONSTRUCTION	A1

NOTE:
ONLY PRINTS WITH A SIGNED SEAL ARE TO BE USED DURING CONSTRUCTION AND CONSIDERED OFFICIAL COPIES. THESE PLANS ARE NOT TRANSFERABLE.

PROFESSIONAL ENGINEER
EXPIRES 11-30-2017
SIGNATURE
05-11-2017
DATE

REV	DESCRIPTION	P.S.	P.E.	DATE
A2	05-11-17 ISSUED FOR CONSTRUCTION	LHS	JHB	MCT
A1	04-03-17 REVISED PER PCD COMMENTS	ANC	JHB	MCT
A0	03-24-17 FOR OUC REVIEW	LHS	JHB	MCT

COMED DISTRIBUTION CONDUIT INSTALLATION
319-342 E. ILLINOIS ST.
FOR 465 N. PARK DR.
TITLE, LOCATION MAP, LEGEND, INDEX TO SHEETS

LHS	312-353-1800		LHS
PROJECT ENGINEER	PHONE NO.		PROJECT DESIGNER
05-11-17	AS SHOWN	-	14017522
DATE	SCALE	P.E. NO.	PASSPORT W/O
ComEd	RM-01		01 OF 15 PAGE
	DRAWING NO.		

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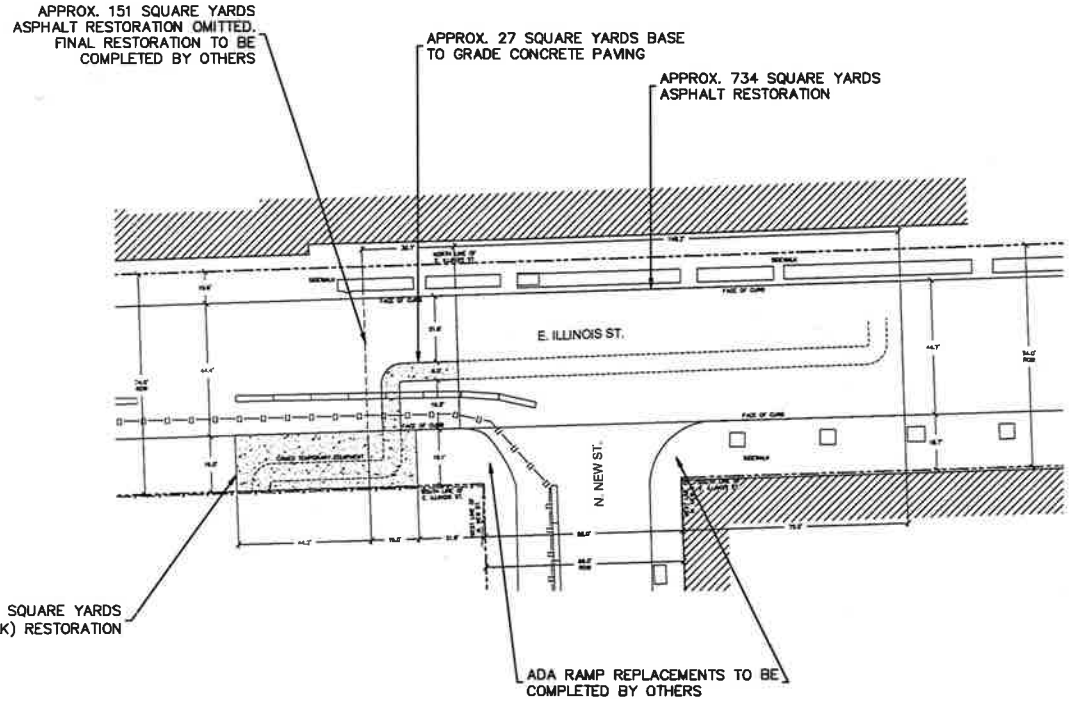
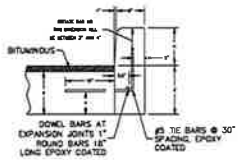
PROJ. No. 16-1287

UIC-03

CE-ST-828

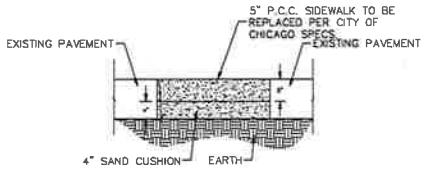




LEGEND:

H. VARIABLE 3" TO 9"
X. THICKNESS OF PAVEMENT
Y. ONE HALF THICKNESS OF CONCRETE PAVEMENT OR CONCRETE BASE
Z. 10" OR THICKNESS OF PAVEMENT – WHICHEVER IS GREATER

TYPE B OR TYPE A CURB BARRIER DETAIL



SIDEWALK RESTORATION DETAIL

NOTE: THE PAVEMENT RESTORATION DETAIL PROVIDED ON THIS SHEET IS TYPICAL. CONTRACTOR TO RESTORE PAVEMENT TO MATCH CURB AND FLOW LINE CONFIGURATION OF ADJACENT AREA.

PROFESSIONAL ENGINEER
EXPIRES 11-30-2017

SIGNATURE

05-11-2017
DATE

REV	DESCRIPTION	P.D.	P.E.	DATE
A2	05-11-17 ISSUED FOR CONSTRUCTION	LVS	JHB	MCT
A1	04-03-17 REVISED PER PDD COMMENTS	ANC	JHB	MCT
A0	03-08-17 FOR QUC REVIEW	LVS	JHB	MCT

COMED DISTRIBUTION CONDUIT INSTALLATION
319-342 E. ILLINOIS ST.
FOR 465 N. PARK DR.
RESTORATION PLAN

PROJECT ENGINEER	PHONE NO.	PROJECT DESIGNER
LVS	312-253-1800	LVS
05-11-17	AS SHOWN	–
DATE	SCALE	P.I. NO.
		14017020
		PASSPORT W/O

ComEd — UIC-03 — 04 OF 15 PAGE
DRAWING NO.

0 10 20 40
1 inch = 20 ft.

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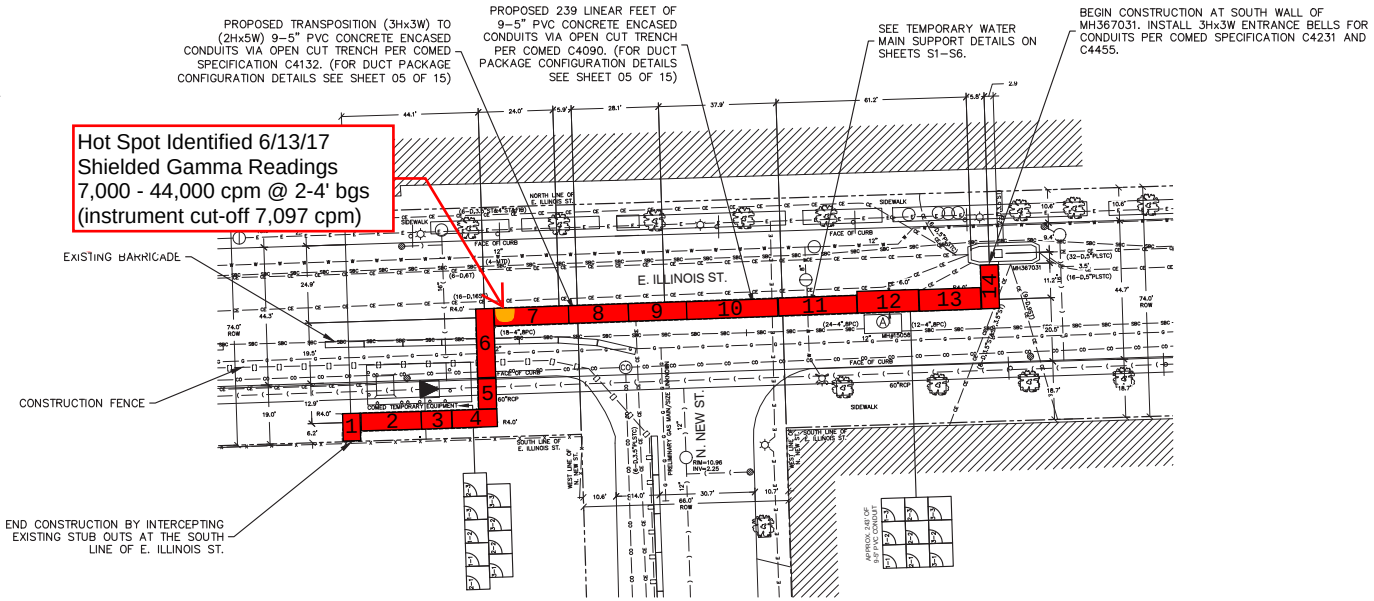
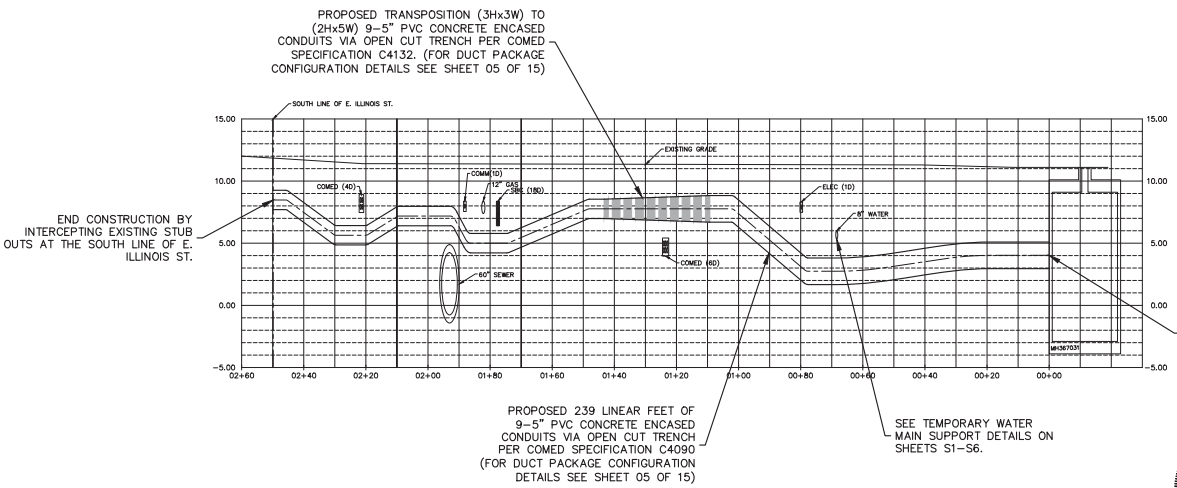
PROJ. No. 16-1287

Annotated Drawing and Tabulated Results

CE-ST-828





VERTICAL SCALE
0 2.5 5 10
1 inch = 5 ft.

HORIZONTAL SCALE
0 10 20 40
1 inch = 20 ft.

GENERAL CONSTRUCTION NOTES

1. ALL WORK DONE BY CONTRACTOR/INSTALLER PURSUANT TO THIS DRAWING SHALL:
(A) CONFORM TO THE GOVERNING CONTRACT DOCUMENTS
(B) BE PERFORMED EXCLUSIVELY BY ITS TRAINED, COMPETENT PERSONNEL OR, WHERE PERMITTED, THAT OF ITS SUBCONTRACTOR(S)
(C) COMPLY WITH ALL APPLICABLE SAFETY LAWS, REGULATIONS, PROGRAMS AND PRACTICES TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING THE CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

2. REFERENCES USED HAVE BEEN IDENTIFIED ON EXCAVATION/FOUNDATION/DEMOLITION DRAWINGS AND HAVE BEEN PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD FOR LOCATING EXISTING UTILITIES AND OTHER POTENTIAL UNDERGROUND OR EMBEDDED INTERFERENCES. THESE REFERENCES ONLY SHOW THE APPROXIMATE LOCATION OF POTENTIAL UNDERGROUND OR EMBEDDED UTILITIES AND MAY NOT INDICATE OR REFLECT ALL EXISTING UNDERGROUND OR EMBEDDED UTILITIES OR THEIR ACTUAL LOCATIONS.

3. UNDERGROUND OR EMBEDDED UTILITIES (MAY) EXIST WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK. THE LOCATION OR IDENTIFICATION OF SUCH UTILITIES HAS NOT BEEN VERIFIED BY OWNER OR BY HBK ENGINEERING. CONTRACTOR/INSTALLER IS RESPONSIBLE FOR FIELD LOCATING AND IDENTIFYING UNDERGROUND AND EMBEDDED UTILITIES AND ANY OTHER UNDERGROUND AND EMBEDDED UTILITY DIMENSIONS.

4. REFERENCES IDENTIFIED SHALL NOT SUBSTITUTE FOR THE CONTRACTOR'S/INSTALLER'S OBLIGATION TO FIELD LOCATE ANY UNDERGROUND OR EMBEDDED UTILITIES OR INTERFERENCES THAT MAY AFFECT THE WORK.

5. DUE CAUTION SHALL BE TAKEN DURING ANY EXCAVATION/FOUNDATION/DEMOLITION WORK WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK DUE TO POSSIBLE INTERFERENCES THAT MAY NOT BE REFLECTED ON THE REFERENCES IDENTIFIED.

6. CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

7. THE UNDERGROUND UTILITY LOCATIONS SHOWN ON THIS PLAN WERE DERIVED FROM DRAWINGS PROVIDED BY COMMONWEALTH EDISON AND THE CHICAGO DEPARTMENT OF TRANSPORTATION – OFFICE OF UNDERGROUND'S UTILITY SEARCH PROCESS. EXISTING FACILITY LOCATIONS ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION. "DIGGER" IS TO BE NOTIFIED 48 HOURS PRIOR TO THE START OF ANY EXCAVATION WORK ON THIS PROJECT. (312-744-7000).

8. CONTRACTOR SHALL VERIFY LOCATIONS OF CONDUIT DEAD-ENDS WITH COMED CONSTRUCTION SUPERVISOR.

9. THE CONTRACTOR IS ADVISED TO MAINTAIN THE APPROVED MINIMUM 4'-0" HORIZONTAL AND 1'-6" VERTICAL CLEARANCES BETWEEN EXISTING SEWER AND SEWER STRUCTURES AND 3'-0" HORIZONTAL AND 1'-6" MINIMUM VERTICAL SEPARATION FOR ALL EXISTING WATER MAINS AND STRUCTURES. DEPARTMENT OF WATER MANAGEMENT FACILITIES DAMAGED DURING THIS WORK MUST BE REPORTED TO THE ENGINEERING SECTION AND MUST BE REPAIRED BY A "LICENSED DRAIN LAYER" UNDER SUPERVISION OF THE MASON INSPECTOR AND SEWER PERMIT UNIT AT 312-747-7049, 312-747-7893, RESPECTIVELY.

10. THE EXISTING ABOVE GROUND UTILITY STRUCTURES AND IMPROVEMENTS SHOWN ON THIS PLAN WERE FIELD LOCATED AND VERIFIED UTILIZING CONVENTIONAL (TOTAL STATION) DATA COLLECTION METHODS.

11. RESTORE PAVEMENT TO NEAREST JOINT PER CDOT STANDARDS.

12. A REPRESENTATIVE OF THE DWM MUST BE ON SITE DURING EXCAVATION NEAR THE 8-INCH MAIN(S). CONTACT JOHN BARBARO AT (312) 894-4462 OR JOHN.BARBARO@CITYWATER.NET TWO WEEKS PRIOR TO THE ANTICIPATED CONSTRUCTION DATE SO A DWM REPRESENTATIVE CAN BE ASSIGNED TO THE PROJECT. HAND EXCAVATION IS REQUIRED TO FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF THE 8-INCH WATER MAIN PRIOR TO CROSSING. DIRECTIONAL BORING METHOD OF INSTALLATION TO CROSS THIS EXISTING FEEDER MAIN IS PROHIBITED. IF A TRENCHLESS METHOD OF INSTALLATION IS USED, A MINIMUM 4-FOOT OF UNDISTURBED SOIL IS TO REMAIN ON EITHER SIDE OF THE EXISTING WATER MAIN. IF THE PROPOSED FACILITY WILL BE INSTALLED VIA OPEN-CUT METHOD, THE EXCAVATION MUST BE PROPERLY SHORED TO MAINTAIN A MAXIMUM 3-FOOT TRENCH WIDTH. THE TRENCH SHALL BE BACKFILLED TO THE SPRINGLINE OF THE WATER MAIN WITH CLSM BACKFILL (NON FLY ASH), AND CA-16 FROM THE SPRINGLINE OF THE WATER MAIN TO GRADE. USE OF POLYETHYLENE WRAP AS A BOND BREAKER BETWEEN THE WATER MAIN AND THE CLSM BACKFILL IS REQUIRED. FAILURE TO COMPLY WITH THESE REQUIREMENTS MAY RESULT IN ADDITIONAL EXPENSES TO THE PROPOSED PROJECT TO VERIFY THAT ALL WORK CONFORMS TO DWM'S STANDARDS. EXTREME CAUTION MUST BE TAKEN TO AVOID DAMAGE TO ANY WATER FACILITIES. IF DAMAGE OCCURS TO THIS DEPARTMENT'S FACILITIES, THE CONTRACTOR AND/OR COMED WILL BE RESPONSIBLE FOR THE COST OF REPAIRING OR REPLACING THE DAMAGED FACILITIES.

ILLINOIS PROFESSIONAL ENGINEER
MICHAEL C. TEDESCHI
062482700
STATE OF ILLINOIS

PROFESSIONAL ENGINEER
EXPIRES 11-30-2017
SIGNATURE
03-08-2017
DATE

REV	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
A	03-08-17	FOR OUC REVIEW	LHS	JHB	MCT

REV	DESCRIPTION	P.D.	P.E.	DATE

COMED DISTRIBUTION CONDUIT INSTALLATION
319-342 E. ILLINOIS ST.
FOR 465 N. PARK DR.
PLAN AND PROFILE

LHS	312-253-1800	LHS
PROJECT ENGINEER	PHONE NO.	PROJECT DESIGNER
04-03-17	AS SHOWN	–	14017522
DATE	SCALE	P.L. NO.	PASSPORT W/O
ComEd Distribution Lines Engineering	UIC-02		03 OF 15 PAGE
		DRAWING NO.	

hbk ENGINEERING

HBK ENGINEERING, LLC
921 WEST VAN BUREN, SUITE 100
CHICAGO, IL 60607
PHONE: (312) 432-8076 FAX: (312) 432-8231
STATE OF ILLINOIS, DEPARTMENT OF PROFESSIONAL REGULATION, LICENSE NO. 184-002308

PROJ. No. 16-1287

465 N. Park Ave
ComEd Conduit Installation (Shielded
Gamma Counts May 31 - June 16, 20/17

Section	Depth	CPM
1	0" (concrete)	-
	12" (sub-base)	-
	12-16" (fill)	1,200 - 1,600
	16-60" (spoil)	1,500 - 4,700
2	0" (concrete)	-
	6" (sub-base)	-
	24"	3,100 - 3,400
	24-60" (spoil)	1,400 - 3,400
	60"	2,600 - 4,100
3	0" (concrete)	-
	6" (sub-base)	1,300 - 1,400
	6-60" (spoil)	1,400 - 3,400
	60"	2,600 - 3,900
4	0" (concrete)	
	21"	1,900 - 2,800
	36"	3,100 - 3,800
	54-60"	2,200 - 3,300
5	0" (concrete)	-
	18"	1,700 - 2,200
	36"	1,900 - 2,300
	54"	1,500 - 2,600
6	0" (concrete)	-
	24"	2,200 - 4,200
	40"	1,600 - 3,100
	46"	2,200 - 3,200
	64-78" (south end)	1,500 - 4,800
7	0" (concrete)	-
	18"	1,400 - 2,600
	36"	1,400 - 1,800
	48"	1,800 - 2,700
8	0" (concrete)	-
	18"	1,800 - 2,300
	36"	1,900 - 2,400
	48"	1,600 - 2,400
9	0" (concrete)	-
	18"	1,500 - 1,800
	36"	1,800 - 3,100
	48"	1,700 - 2,700
10	0" (concrete)	-
	18"	1,400 - 1,700
	36"	1,800 - 2,300
	48"	1,500 - 1,700
11	0" (concrete)	-
	18"	1,200 - 1,800
	36"	1,300 - 1,700
	48"	1,300 - 1,900
12	0" (concrete)	-
	18"	700 - 1,100
	36"	1,200 - 1800
	48"	1,100 - 1,900
13	0" (concrete)	-
	18"	1,100 - 1,600
	36"	1,200 - 1,800
	48"	1,100 - 1,900
	54"	1,800 - 2,200
14	0" (concrete)	-
	18"	1,600 - 2,100
	36"	1,600 - 2,300
	52"	1,800 - 2,800
	70" (north end)	2,200 - 2,800
	84" (north end)	2,100 - 2,700

Gamma Spec. Results

RSSI

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

Thursday, June 15, 2017

Steve Kornder
AECOM
303 E. Wacker Dr.
Suite 1400
Chicago, IL 60601

RE: 465-CET

Dear Dr. Kornder:

A summary of gamma spectroscopy results for our sample number G170132 is in Table 1. AECOM identified the sample as 465-CET. The table below lists the concentrations of selected radionuclides. Values with a less-than symbol ("<") indicate a concentration below RSSI's minimum detectable concentration (MDC). Additional identified radionuclides are in the complete gamma spectroscopy report.

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

Radionuclide	Sample G170132 465-CET
Pb-214	7.35
Bi-214	7.17
Ra-226[1]	7.26
Ac-228	82.16
Ra-228[2]	82.16
Th-232[3]	82.16
Tl-208	23.35
K-40	7.35
Pb-212	68.05
Bi-212	82.62
Th-234	8.83
Pa-234m	23.97
U-238[4]	16.40

[1] The concentration of Ra-226 is based on the average concentration of Pb-214 and Bi-214.
[2] The concentration of Ra-228 is based on the surrogate Ac-228.
[3] The concentration of Th-232 is based on the surrogate Ac-228.
[4] The concentration of U-238 is based on the average concentrations of Th-234 and Pa-234m.

Some radionuclides of interest, thorium-232 (Th-232), radium-226 (Ra-226), radium-228 (Ra-228), 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 high energy photons usually represent the concentration of Th-232, Ra-226, Ra-228, and U-238. The successful use of surrogates depends upon the radionuclides in each series being in equilibrium.

Radium-226 (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. 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. As a standard protocol, samples are normally held for 30-days to reestablish equilibrium. These samples were analyzed as received and were not held for in-growth. The average of the activities of Pb-214 and Bi-214 is shown as the activity of Ra-226.

Both Th-232 and Ra-228, in the thorium series, emit photons with very low gamma fractions at very low energies. In the thorium series, actinium-228 (Ac-228) is usually in equilibrium with both Th-232 and Ra-228 when collected. 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 at low energies. Thorium-234 (Th-234) and protactinium-234m (Pa-234m), both with photons at higher energies and with larger gamma fractions, are usually in

equilibrium with U-238. The average of the activities of Th-234 and Pa-234m is shown as the activity of U-238.

These samples were run as-received and these results have not been corrected for moisture content.

The complete spectroscopy analysis results are attached. 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 15-JUN-2017 10:17:20
RSSI Spectrum name: G170132.An1

Sample description
G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.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	1 Sigma Total
AC-228		8.2162E-05	3.566E-01%	2.741E+00%
PB-214		7.3541E-06	1.240E+00%	5.217E+00%
BI-214		7.1732E-06	1.594E+00%	3.774E+00%
K-40		7.3521E-06	4.893E+00%	6.098E+00%
Th-234	C	8.8288E-06	3.442E+01%	3.456E+01%
Pa-234m		2.3968E-05	1.705E+01%	1.723E+01%
Pb-212		6.8051E-05	1.771E-01%	6.421E+00%
Bi-212		8.2622E-05	1.041E+00%	3.314E+00%
Tl-208		2.3347E-05	3.991E-01%	3.517E+00%
U-235	<	1.6242E-07		
Ra-224		6.9951E-05	1.524E+00%	6.581E+00%
Th-228		1.2370E-04	2.897E+00%	4.625E+00%

< - 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 (1729.5 to 1754.7 keV) 5.045E-04 uCi/g
This section based on library: AECOM - 2017-06.Lib

ORTEC g v - i (1215) Env32 G53W4.22 15-JUN-2017 10:17:20
RSSI Spectrum name: G170132.An1

Sample description
G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.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	8.2162E-05					
			911.20	8.278E-05	(P	9.870E-08 4.04E-01	G
			968.97	8.115E-05	(P	1.681E-07 5.87E-01	G
			338.32	6.801E-05 -	P	3.921E-07 4.42E-01	G
			964.77	7.286E-05 -	P	1.044E-06 1.67E+00	G
			463.00	6.671E-05 -	P	8.118E-07 1.22E+00	G
			93.35	9.155E-05 +		1.301E-06 1.28E+00	XA
			89.96	8.216E-05 }		2.280E-06 2.02E+00	XA
			1638.28	1.117E-04 +		7.686E-06 9.82E+00	GA
			1630.63	1.095E-04 +		2.967E-06 2.70E+00	G
			1588.19	1.068E-04 +	P	1.947E-06 1.40E+00	G
			1580.53	1.040E-04 +		5.674E-06 6.93E+00	GA
			1557.10	1.817E-04 +		1.749E-05 1.79E+01	GA
			1501.57	1.126E-04 +		7.140E-06 5.60E+00	GA
			1495.93	1.182E-04 +		4.669E-06 3.30E+00	GA
			1459.14	6.642E-05 -		5.287E-06 7.43E+00	GA
			1110.61	1.412E-04 +		8.553E-06 7.63E+00	GA
			1065.19	3.081E-04 +		1.860E-05 9.69E+00	GA
			904.19	6.929E-05 -		3.728E-06 7.84E+00	GA
			840.38	6.938E-05 -		3.280E-06 5.65E+00	GA
			835.71	7.313E-05 -		2.045E-06 3.05E+00	GA
			830.49	8.183E-05		4.805E-06 7.10E+00	GA
			794.95	7.036E-05 -	P	1.063E-06 1.67E+00	G
			782.14	7.645E-05 -		5.407E-06 6.59E+00	GA
			772.29	6.668E-05 -		2.311E-06 4.75E+00	G
			755.32	7.455E-05 -		3.396E-06 5.62E+00	G
			562.50	7.428E-05 -		3.195E-06 5.31E+00	GA
			478.40	7.834E-05		9.321E-06 1.56E+01	GA
			409.46	6.415E-05 -	P	1.374E-06 2.34E+00	G
			328.00	6.820E-05 -	P	1.044E-06 1.89E+00	G
			270.25	6.415E-05 -	P	8.223E-07 1.59E+00	G
			209.25	6.214E-05 -	P	7.893E-07 1.50E+00	G
			153.98	6.668E-05 -		3.223E-06 6.38E+00	GA
			129.06	5.476E-05 -	P	1.123E-06 2.45E+00	GA
			108.58	1.277E-04 +		9.530E-06 9.78E+00	XA
			105.60	1.373E-04 +	P	4.418E-06 4.42E+00	XA
			99.51	5.699E-05 -		2.476E-06 4.18E+00	GA
PB-214	N	7.3541E-06					
			351.93	7.402E-06	(P	5.226E-08 1.23E+00	G
			295.22	6.767E-06 -	P	1.389E-07 2.83E+00	G
			242.00	7.110E-06	(P	3.708E-07 5.33E+00	G
			258.87	5.206E-06 -		3.110E-06 7.65E+01	G
			785.96	7.354E-06 }		2.827E-06 2.85E+01	G Energy duplication
			77.11	7.354E-06 }	P	1.076E-06 3.61E+00	XA Energy duplication
			74.82	7.354E-06 }		1.741E-06 3.56E+00	XA Energy duplication
			89.78	7.354E-06 }		6.784E-06 4.76E+01	XA
BI-214	N	7.1732E-06					
			609.31	7.173E-06	(P	5.896E-08 1.58E+00	G
			1120.29	9.376E-06 +	P	2.632E-07 3.56E+00	G

Sample description
G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.An1

			1764.49	0.000E+00	=	0.000E+00	0.00E+00	G	
			768.36	5.836E-06	- P	5.529E-07	1.30E+01	G	
			1238.11	1.046E-05	+ P	5.695E-07	8.60E+00	G	
			934.06	8.593E-06	+ P	7.610E-07	1.12E+01	G	
			1377.67	1.781E-05	+ P	9.098E-07	8.09E+00	G	
			1729.60	2.517E-05	+ P	1.561E-06	1.01E+01	G	
			1509.23	0.000E+00	& P	4.809E-07	4.70E+03	G	
			1407.98	1.176E-05	+ P	1.252E-06	1.39E+01	G	
			1401.50	1.359E-05	+	2.081E-06	2.46E+01	GA	
			1280.96	1.031E-05	+	1.716E-06	2.52E+01	GA	
			665.45	6.650E-06	-	1.581E-06	2.32E+01	GA	
			89.81	0.000E+00		5.165E-08	0.00E+00	XA	
			89.26	7.173E-06	}	4.365E-05	2.87E+02	XA	
K-40	N	7.3521E-06							
			1460.82	7.352E-06	(P	3.321E-07	3.78E+00	G	
Th-234	N	8.8288E-06							
			92.38	1.279E-08	} P	1.513E-06	6.41E+03	G	
			92.80	5.663E-06	} P	1.518E-06	1.19E+01	G	
			63.29	8.829E-06	(P	2.192E-06	3.34E+01	G	
Pa-234m	N	2.3968E-05							
			1001.03	2.397E-05	(P	2.085E-06	1.65E+01	G	
			98.43	0.000E+00	% P	1.195E-05	1.08E+02	XA	
Pb-212	N	6.8051E-05							
			238.63	6.802E-05	(P	4.683E-08	1.77E-01	G	
			300.09	6.453E-05	-	8.789E-07	1.95E+00	G	
			115.18	7.010E-05	(	4.365E-06	8.90E+00	G	
									Energy duplication
			77.11	6.690E-05	} P	3.280E-07	5.63E-01	XA	
									Energy duplication
			74.82	6.805E-05	} P	6.626E-07	9.79E-01	XA	
			87.35	6.805E-05	}	1.257E-06	1.21E+00	XA	
			86.83	6.805E-05	}	2.504E-06	3.31E+00	XA	
									Energy duplication
			89.78	6.805E-05	}	3.113E-06	2.12E+00	XA	
Bi-212	N	8.2622E-05							
			727.33	8.262E-05	(P	4.433E-07	1.04E+00	G	
			785.37	6.865E-05	}	2.777E-06	3.33E+00	G	
			288.20	7.368E-05	-	5.355E-06	6.99E+00	G	
			1620.50	1.278E-04	+	3.455E-06	4.33E+00	G	
Tl-208	N	2.3347E-05							
			583.19	2.335E-05	(P	3.472E-08	3.99E-01	G	
			277.35	2.105E-05	- P	3.976E-07	2.20E+00	G	
			860.56	2.725E-05	+ P	3.797E-07	1.33E+00	G	
									Energy duplication
			74.97	2.335E-05	}	2.392E-06	7.45E+00	XA	
			72.81	4.636E-05	+	3.434E-06	7.26E+00	XA	
U-235	N	0.0000E+00							
			143.76	0.000E+00	%	1.624E-07	1.00E+03	G	
			163.36	0.000E+00	%	3.347E-07	1.00E+03	G	
			205.31	0.000E+00	&	3.547E-07	1.00E+03	G	
			93.35	0.000E+00	%	4.049E-07	1.00E+03	XA	
			89.96	0.000E+00	%	7.219E-07	1.00E+03	XA	

Sample description
G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.An1

Ra-224	N	6.9951E-05				
		240.99	6.995E-05	(	1.002E-06	1.52E+00 G
Th-228	N	1.2370E-04				
		84.37	1.237E-04	(	3.398E-06	2.90E+00 G
		215.98	8.343E-05	-	8.791E-06	1.48E+01 G
		166.41	8.983E-05	-	1.916E-05	2.78E+01 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: AECOM - 2017-06.Lib

ORTEC g v - i (1215) Env32 G53W4.22 15-JUN-2017 10:17:20
RSSI Spectrum name: G170132.An1

Sample description
G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.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
112.26	24.01	47864.	7639.	0.707	4.21	1.084	-	D
114.19	24.43	36741.	28473.	2.636	1.12	1.084	-	D
125.30	26.82	59126.	12133.	1.123	2.98	1.084	-	D
138.08	29.57	55808.	1760.	0.163	25.23	0.936	-	D
156.37	33.50	56700.	1581.	0.146	30.23	1.424	-	sD
183.89	39.42	44710.	2875.	0.266	14.52	0.725	-	s
350.79	75.34	70290.	2769.	0.256	13.68	1.085	-	D
407.81	87.61	64229.	2652.	0.246	13.65	1.085	-	D
421.47	90.55	64229.	4230.	0.392	8.61	1.086	-	D
600.59	129.10	78254.	500.	0.046	79.24	1.089	-	c
613.53	131.89	53045.	1545.	0.143	28.00	0.837	-	sM
657.28	141.30	36956.	492.	0.046	65.97	0.608	-	s
679.09	146.00	39146.	1458.	0.135	23.65	0.971	-	s
865.74	186.17	56724.	8256.	0.764	6.22	1.263	-	s
928.42	199.66	45000.	2713.	0.251	15.76	1.212	-	
958.33	206.10	32292.	594.	0.055	53.99	0.456	-	sM
1175.41	252.83	26977.	2241.	0.208	15.40	1.191	-	
1312.59	282.36	17341.	954.	0.088	26.64	0.662	-	s
1495.38	321.71	14632.	1410.	0.131	15.10	1.430	-	s
1545.31	332.46	13544.	2176.	0.202	9.32	0.986	-	M
1585.61	341.05	18426.	2506.	0.232	7.92	1.147	-	D
1743.89	375.22	9112.	240.	0.022	64.80	0.347	-	s
1865.76	401.46	9036.	188.	0.017	77.15	0.522	-	sc
2057.69	442.78	4276.	128.	0.012	72.63	0.255	-	sc
2103.96	452.75	9819.	2267.	0.210	9.17	1.183	-	s
2341.76	503.96	8801.	787.	0.073	22.20	1.441	-	
2372.87	510.66	16491.	36864.	3.413	1.21	1.389	-	s
2460.76	529.59	5341.	111.	0.010	98.29	0.398	-	sc
2908.91	626.11	4268.	246.	0.023	46.51	0.407	-	s
3105.64	668.44	7438.	169.	0.016	72.38	1.357	-	sc
3260.93	701.94	8579.	571.	0.053	31.70	0.430	-	s
3285.41	707.21	7833.	530.	0.049	29.72	1.036	-	s
3353.61	721.90	7740.	623.	0.058	31.83	0.706	-	sM
3404.55	732.88	4888.	174.	0.016	70.01	0.422	-	sM
3546.03	763.36	5583.	1837.	0.170	7.96	1.472	-	M
3610.69	777.29	4387.	137.	0.013	82.83	0.226	-	c
3743.67	805.94	4673.	450.	0.042	31.24	0.775	-	s
4149.57	893.40	3185.	1299.	0.120	10.41	1.624	-	
4399.16	947.18	1935.	159.	0.015	65.36	0.665	-	s
4423.80	952.50	2948.	245.	0.023	52.45	0.441	-	sD
4479.27	964.45	5230.	404.	0.037	25.80	1.674	-	D
4589.96	988.30	2643.	513.	0.047	21.02	1.527	-	
5009.89	1078.82	2282.	1321.	0.122	8.54	1.774	-	
5081.71	1094.30	2509.	1963.	0.182	7.34	1.920	-	s
5263.96	1133.58	1641.	252.	0.023	33.80	0.454	-	s
5651.31	1217.09	1555.	189.	0.017	39.20	0.379	-	s
5790.19	1247.03	2405.	1971.	0.182	8.65	2.488	-	s
6070.77	1307.53	1253.	140.	0.013	48.17	0.408	-	s
7395.92	1593.18	3368.	3800.	0.352	2.70	2.748	-	D
7656.77	1649.62	1104.	444.	0.041	21.26	0.384	-	sM
7712.30	1661.60	1329.	212.	0.020	45.02	0.405	-	s
7824.37	1685.78	1230.	596.	0.055	16.97	0.578	-	s
7900.53	1702.27	1319.	312.	0.029	17.42	2.989	-	D
7934.01	1709.50	855.	265.	0.025	16.78	3.005	-	D

s - Peak fails shape tests.

```
     ORTEC g v - i (1215) Env32  G53W4.22  15-JUN-2017 10:17:20
 RSSI                           Spectrum name: G170132.An1

 Sample description
      G170132 AECOM, 465-CET, 680.2 g

 Spectrum Filename: H:\GammaVision\User\Spectra\G170132.An1
   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: AECOM - 2017-06.Lib
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```
     ORTEC g v - i (1215) Env32  G53W4.22  15-JUN-2017 10:17:20
RSSI                              Spectrum name: G170132.An1

Sample description
     G170132 AECOM, 465-CET, 680.2 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170132.An1
Acquisition information
       Start time:                14-Jun-2017 17:37:16
       Live time:             10800
       Real time:             11117
       Dead time:                 2.85 %
       Detector ID:                  3

Detector system
     CLTCOMP MCB 9


Calibration
       Filename:                  G170132.Spc
     2016-08-17 30% GEM-30185-P Calibration


       Energy Calibration
            Created:              15-Jun-2017 09:25:07
            Zero offset:         -0.146 keV
            Gain:                 0.215 keV/channel
            Quadratic:            3.721E-08 keV/channel^2

       Efficiency Calibration
            Created:              17-Aug-2016 11:26:50
            Type:                 Polynomial
            Uncertainty:          0.520 %
            Coefficients:        -0.457794  -4.470239   0.642789
                                 -0.080870   0.003615  -0.000068

Library Files
       Main analysis library:     AECOM - 2017-06.Lib
       Library Match Width:       0.500
       Peak stripping:            Library based

Analysis parameters
       Analysis engine:           Env32   G53W4.22
       Start channel:            20 (     4.16keV )
       Stop channel:           8144 (  1754.75keV )
       Peak rejection level:    100.000%
       Peak search sensitivity:   3
       Sample Size:               6.8020E+02
       Activity scaling factor:   1.0000E+00/(  1.0000E+00*  6.8020E+02) =
                                  1.4702E-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       2017-02-06 GEM-30185-P Backgroun
                                               06-Feb-2017 11:25:12
       Absorption (Internal):        NO
       Geometry correction:          NO
       Random summing:               NO

total peaks alloc.     87  cutoff   20.00000     %
       Energy Calibration
            Normalized diff:      0.1198
```

RSSI

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

Thursday, June 15, 2017

Steve Kornder
AECOM
303 E. Wacker Dr.
Suite 1400
Chicago, IL 60601

RE: 465-CET-1 Composite of remediated fill

Dear Dr. Kornder:

A summary of gamma spectroscopy results for our sample number G170133 is in Table 1. AECOM identified the sample as 465-CET-1. The table below lists the concentrations of selected radionuclides. Values with a less-than symbol ("<") indicate a concentration below RSSI's minimum detectable concentration (MDC). Additional identified radionuclides are in the complete gamma spectroscopy report.

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

Radionuclide	Sample G170133 465-CET-1
Pb-214	1.64
Bi-214	1.80
Ra-226[1]	1.73
Ac-228	15.92
Ra-228[2]	15.92
Th-232[3]	15.92
Tl-208	5.35
K-40	6.02
Pb-212	15.63
Bi-212	18.99
Th-234	4.16
Pa-234m	6.90
U-238[4]	5.53

[1] The concentration of Ra-226 is based on the average concentration of Pb-214 and Bi-214.
[2] The concentration of Ra-228 is based on the surrogate Ac-228.
[3] The concentration of Th-232 is based on the surrogate Ac-228.
[4] The concentration of U-238 is based on the average concentrations of Th-234 and Pa-234m.

Some radionuclides of interest, thorium-232 (Th-232), radium-226 (Ra-226), radium-228 (Ra-228), 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 high energy photons usually represent the concentration of Th-232, Ra-226, Ra-228, and U-238. The successful use of surrogates depends upon the radionuclides in each series being in equilibrium.

Radium-226 (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. 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. As a standard protocol, samples are normally held for 30-days to reestablish equilibrium. These samples were analyzed as received and were not held for in-growth. The average of the activities of Pb-214 and Bi-214 is shown as the activity of Ra-226.

Both Th-232 and Ra-228, in the thorium series, emit photons with very low gamma fractions at very low energies. In the thorium series, actinium-228 (Ac-228) is usually in equilibrium with both Th-232 and Ra-228 when collected. 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 at low energies. Thorium-234 (Th-234) and protactinium-234m (Pa-234m), both with photons at higher energies and with larger gamma fractions, are usually in

equilibrium with U-238. The average of the activities of Th-234 and Pa-234m is shown as the activity of U-238.

These samples were run as-received and these results have not been corrected for moisture content.

The complete spectroscopy analysis results are attached. 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 15-JUN-2017 17:48:15
RSSI Spectrum name: G170133.An1

Sample description
G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.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		1.5920E-05	1.450E+00%	3.080E+00%
PB-214		1.6443E-06	5.184E+00%	7.250E+00%
BI-214		1.8094E-06	4.121E+00%	5.356E+00%
K-40		6.0213E-06	5.453E+00%	6.556E+00%
Th-234	C	4.1582E-06	4.637E+01%	4.648E+01%
Pa-234m#		6.8974E-06	3.451E+01%	3.460E+01%
Pb-212		1.5626E-05	5.547E-01%	6.443E+00%
Bi-212		1.8987E-05	3.666E+00%	4.831E+00%
Tl-208		5.3504E-06	1.146E+00%	3.678E+00%
U-235	<	1.1955E-07		
Ra-224		1.4045E-05	5.942E+00%	8.735E+00%
Th-228	<	2.6917E-06		

- 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 (1495.8 to 1754.0 keV) 9.046E-05 uCi/g
This section based on library: AECOM - 2017-06.Lib

Sample description
G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.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	Peak Activity uCi/g	Peak Code	MDA Value uCi/g	COMMENTS
AC-228	N	1.5920E-05					
			911.20	1.600E-05	(P	7.123E-08 1.44E+00	G
			968.97	1.588E-05	(P	1.138E-07 1.90E+00	G
			338.32	1.331E-05	- P	2.695E-07 1.89E+00	G
			964.77	1.450E-05	- P	6.965E-07 4.93E+00	G
			463.00	1.361E-05	- P	5.943E-07 5.06E+00	G
			93.35	1.761E-05	+	9.341E-07 4.86E+00	XA
							Energy duplication
			89.96	1.592E-05	}	1.598E-06 7.60E+00	XA
			1638.28	3.371E-05	+	5.235E-06 2.03E+01	GA
			1630.63	2.408E-05	+	2.162E-06 9.61E+00	G
			1588.19	1.810E-05	+ P	1.280E-06 7.82E+00	G
			1580.53	2.749E-05	+	3.899E-06 1.53E+01	GA
			1557.10	2.816E-05	+	8.621E-06 3.54E+01	GA
			1501.57	2.269E-05	+	4.124E-06 1.94E+01	GA
			1495.93	2.885E-05	+	3.406E-06 1.54E+01	GA
			1459.14	2.156E-05	+	5.268E-06 2.30E+01	GA
			1110.61	4.288E-05	+	6.219E-06 1.79E+01	GA
			1065.19	0.000E+00		5.301E-07 0.00E+00	GA
			904.19	1.243E-05	-	2.447E-06 2.62E+01	GA
			840.38	1.905E-05	+	2.371E-06 1.71E+01	GA
			835.71	1.717E-05	+	1.451E-06 9.69E+00	GA
			830.49	2.108E-05	+	3.367E-06 2.03E+01	GA
			794.95	1.467E-05	- P	7.261E-07 4.81E+00	G
			782.14	1.579E-05		3.880E-06 2.28E+01	GA
			772.29	1.767E-05	+	1.649E-06 1.22E+01	G
			755.32	1.822E-05	+	2.462E-06 1.67E+01	G
			562.50	1.596E-05		2.294E-06 2.37E+01	GA
			478.40	3.551E-05	+	8.208E-06 3.11E+01	GA
			409.46	1.511E-05	@(P	8.032E-07 7.54E+00	G
			328.00	1.381E-05	- P	7.161E-07 6.16E+00	G
			270.25	1.325E-05	- P	5.703E-07 4.81E+00	G
			209.25	1.380E-05	- P	5.606E-07 5.26E+00	G
			153.98	1.662E-05		2.371E-06 1.87E+01	GA
			129.06	1.123E-05	- P	8.354E-07 9.19E+00	GA
			108.58	3.042E-05	+	6.634E-06 2.71E+01	XA
			105.60	3.340E-05	+ P	3.274E-06 1.34E+01	XA
			99.51	1.207E-05	-	1.773E-06 1.41E+01	GA
PB-214	N	1.6443E-06					
			351.93	1.630E-06	(P	4.630E-08 5.09E+00	G
			295.22	2.014E-06	+ P	1.001E-07 6.18E+00	G
			242.00	1.715E-06	(P	2.642E-07 1.56E+01	G
			258.87	2.981E-06	+	2.099E-06 7.69E+01	G
			785.96	0.000E+00		4.908E-08 0.00E+00	G
							Energy duplication
			77.11	1.644E-06	} P	7.706E-07 6.19E+00	XA
							Energy duplication
			74.82	1.644E-06	}	1.057E-06 6.16E+00	XA
							Energy duplication
			89.78	0.000E+00		3.908E-08 0.00E+00	XA
BI-214	N	1.8094E-06					
			609.31	1.809E-06	(P	3.909E-08 4.03E+00	G

Sample description
G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.An1

			1120.29	2.200E-06	+ P	1.818E-07	8.67E+00	G
			1764.49	0.000E+00	=	0.000E+00	0.00E+00	G
			768.36	2.257E-06	+ P	4.083E-07	2.17E+01	G
			1238.11	3.044E-06	+ P	4.223E-07	1.85E+01	G
			934.06	4.295E-06	+ P	6.066E-07	1.81E+01	G
			1377.67	3.051E-06	+ P	5.731E-07	2.46E+01	G
			1729.60	5.245E-06	+ P	9.441E-07	2.41E+01	G
			1509.23	3.153E-06	+ P	8.227E-07	2.84E+01	G
			1407.98	3.623E-06	+ P	9.662E-07	3.63E+01	G
			1401.50	6.305E-06	+	1.421E-06	2.58E+01	GA
			1280.96	5.417E-06	+	1.241E-06	2.98E+01	GA
			665.45	0.000E+00		3.077E-08	0.00E+00	GA
							Energy duplication	
			89.81	0.000E+00		1.179E-07	0.00E+00	XA
			89.26	4.107E-05	+	3.027E-05	7.30E+01	XA
K-40	N	6.0213E-06						
			1460.82	6.021E-06	(P	2.662E-07	4.28E+00	G
Th-234	N	4.1582E-06						
			92.38	0.000E+00	} P	1.044E-06	7.12E+03	G
			92.80	1.705E-06	} P	1.063E-06	5.20E+01	G
			63.29	4.158E-06	?(P	1.490E-06	4.42E+01	G
Pa-234m	N	6.8974E-06						
			1001.03	6.897E-06	?(P	1.473E-06	3.19E+01	G
			98.43	0.000E+00	% P	9.377E-06	2.08E+02	XA
Pb-212	N	1.5626E-05						
			238.63	1.565E-05	(P	3.279E-08	5.54E-01	G
			300.09	1.533E-05	(	3.852E-07	4.08E+00	G
			115.18	1.585E-05	(	2.969E-06	2.50E+01	G
							Energy duplication	
			77.11	1.535E-05	} P	2.312E-07	1.82E+00	XA
							Energy duplication	
			74.82	1.563E-05	} P	5.756E-07	3.02E+00	XA
			87.35	1.700E-05	+	9.233E-07	5.02E+00	XA
			86.83	1.660E-05	+	1.800E-06	1.04E+01	XA
							Energy duplication	
			89.78	1.563E-05	}	2.174E-06	1.02E+01	XA
Bi-212	N	1.8987E-05						
			727.33	1.899E-05	(P	3.263E-07	3.66E+00	G
			785.37	1.739E-05	-	1.984E-06	9.98E+00	G
			288.20	1.344E-05	&	4.014E-06	4.70E+01	G
			1620.50	2.766E-05	+	2.408E-06	1.04E+01	G
Tl-208	N	5.3504E-06						
			583.19	5.367E-06	(P	2.319E-08	1.14E+00	G
			277.35	5.127E-06	@(P	2.335E-07	6.21E+00	G
			860.56	6.780E-06	+ P	2.914E-07	4.53E+00	G
							Energy duplication	
			74.97	5.350E-06	}	1.706E-06	2.20E+01	XA
			72.81	1.352E-05	+	2.478E-06	1.78E+01	XA
U-235	N	0.0000E+00						
			143.76	0.000E+00	%	1.195E-07	1.00E+03	G
			163.36	0.000E+00	%	3.015E-07	1.00E+03	G
			205.31	0.000E+00	%	3.600E-07	1.00E+03	G
			93.35	0.000E+00	%	2.927E-07	1.00E+03	XA

Sample description
G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.An1

			89.96	0.000E+00	%	4.947E-07	1.00E+03 XA
Ra-224	N	1.4045E-05					
			240.99	1.405E-05	(	7.989E-07	5.94E+00 G
Th-228	N	0.0000E+00					
			84.37	0.000E+00	%	2.692E-06	1.00E+03 G
			215.98	0.000E+00	%	6.091E-06	1.00E+03 G
			166.41	0.000E+00	%	1.089E-05	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: AECOM - 2017-06.Lib

ORTEC g v - i (1215) Env32 G53W4.22 15-JUN-2017 17:48:15
RSSI Spectrum name: G170133.An1

Sample description
G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.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
114.86	24.46	8001.	7350.	2.042	2.83	1.170	-	s
138.12	29.47	8150.	857.	0.238	19.54	1.160	-	
184.35	39.42	4965.	1144.	0.318	12.67	1.119	-	s
353.03	75.72	7447.	210.	0.058	58.56	1.027	-	D
393.54	84.36	4775.	1126.	0.313	9.18	1.035	-	D
421.00	90.35	6578.	201.	0.056	57.56	1.040	-	D
689.22	148.01	3513.	160.	0.044	53.06	1.087	-	D
865.98	186.13	4185.	814.	0.226	15.28	1.226	-	
992.55	213.37	2764.	156.	0.043	54.03	0.478	-	sM
1098.63	236.02	2456.	227.	0.063	31.52	1.157	-	D
1811.80	389.73	776.	70.	0.020	67.55	0.416	-	s
2106.93	453.27	1112.	344.	0.096	22.34	1.072	-	s
2373.87	510.75	1812.	3707.	1.030	3.15	1.328	-	s
2402.01	516.81	394.	126.	0.035	31.83	0.656	-	s
2783.00	598.85	656.	76.	0.021	58.13	0.269	-	s
2863.99	616.29	477.	57.	0.016	64.83	0.211	-	sM
4451.93	958.31	238.	144.	0.040	31.43	0.512	-	sM
4887.66	1052.19	226.	70.	0.019	49.59	0.326	-	sM
5123.80	1103.06	71.	58.	0.016	31.22	0.522	-	s
5788.06	1246.20	140.	27.	0.007	82.29	0.189	-	sc
6070.54	1307.07	22.	17.	0.005	47.84	0.547	-	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: AECOM - 2017-06.Lib

```
     ORTEC g v - i (1215) Env32  G53W4.22  15-JUN-2017 17:48:15
RSSI                              Spectrum name: G170133.An1

Sample description
     G170133 AECOM, 465-CET-1, 894.1 g

Spectrum Filename: H:\GammaVision\User\Spectra\G170133.An1
Acquisition information
       Start time:                15-Jun-2017 15:55:21
       Live time:              3600
       Real time:              3635
       Dead time:                 0.95 %
       Detector ID:                  3

Detector system
     CLTCOMP MCB 9


Calibration
       Filename:                  G170133.An1
     2016-08-17 30% GEM-30185-P Calibration


       Energy Calibration
            Created:              15-Jun-2017 15:53:38
            Zero offset:         -0.255 keV
            Gain:                 0.215 keV/channel
            Quadratic:            2.512E-08 keV/channel^2

       Efficiency Calibration
            Created:              17-Aug-2016 11:26:50
            Type:                 Polynomial
            Uncertainty:          0.520 %
            Coefficients:        -0.457794  -4.470239   0.642789
                                 -0.080870   0.003615  -0.000068

Library Files
       Main analysis library:     AECOM - 2017-06.Lib
       Library Match Width:       0.500
       Peak stripping:            Library based

Analysis parameters
       Analysis engine:           Env32   G53W4.22
       Start channel:            20 (     4.05keV )
       Stop channel:           8144 (  1754.03keV )
       Peak rejection level:    100.000%
       Peak search sensitivity:   3
       Sample Size:               8.9410E+02
       Activity scaling factor:   1.0000E+00/(  1.0000E+00*  8.9410E+02) =
                                  1.1184E-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       2017-02-06 GEM-30185-P Backgroun
                                               06-Feb-2017 11:25:12
       Absorption (Internal):        NO
       Geometry correction:          NO
       Random summing:               NO

total peaks alloc.     79  cutoff   20.00000     %
       Energy Calibration
            Normalized diff:      0.1196
```

USEPA ANALYTICAL

Gamma Spectroscopy

Case Narrative

Tetra Tech, Inc.

Lindsay Light – 465 N. Park

Work Order Number: 1706376

1. This report consists of analytical results and supporting documentation for two soil samples received by ALS on 06/16/2017.

2. These samples were prepared according to the current revision of SOP739.

3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP713. The analyses were completed on 06/19/2017.

4. The analysis results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.

5. Sample volume was insufficient to allow preparation of a duplicate. A duplicate analysis of sample 1706376-1 was performed in lieu of a prepared duplicate.

6. Activity concentrations above the calculated MDC are reported in some instances where minimum nuclide identification criteria are not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the ‘diagnostic’ peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Nuclides not meeting these requirements have been flagged with a “TI” qualifier.

7. In cases where there are no peaks found in the peak search routine, the software performs a net quantification. This indicates that nuclides are not detected or supported at any level above the reported MDC. Consequently, these nuclides are flagged with an “NQ” qualifier on the final reports. Please refer to the Technical Bulletin Addendum in section 5 of this report.

8. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of +/- 15% of the density of the calibration standard are flagged with a ‘G’, denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.

9. The volume of all samples was not within 0.5 cm of the associated calibration volume as required per the current revision of SOP 739. Therefore, any reported results for these samples are flagged with a "J" qualifier, indicating the activity values to be an estimated value. Results are reported without further qualification.

10. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.

11. There are cases where the magnitude of negative activity is greater than the 3σ TPU. ALS is currently investigating the possible cause and frequency of this occurrence. Review of the data does not indicate a problem with the instrument or reporting systems and results are reported without further qualification.

12. ALS uses the following convention for reporting significant digits in the TPU and MDC results. The TPU value is rounded to two significant digits. The MDC value is rounded to the same decimal place as the TPU value. In practice, this could result in an MDC reported value of zero for samples with significant activity, including the batch laboratory control sample.

13. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen — 6/20/17
Radiochemistry Primary Data Reviewer — Date

Radiochemistry Final Data Reviewer — 6/20/17
Date

1

Section 1

CHAIN OF CUSTODY

ALS -- Fort Collins

Sample Number(s) Cross-Reference Table

OrderNum: 1706376
Client Name: Tetra Tech, Inc.
Client Project Name: Lindsay Light - 465 N. Park
Client Project Number:
Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
LL-170615-AFV	1706376-1		SOIL	15-Jun-17	
LL-170615-BW	1706376-2		SOIL	15-Jun-17	

ENVIRONMENTAL PROTECTION AGENCY
· Office of Enforcement

1706376

REGION 5
77 West Jackson Boulevard
Chicago, Illinois 60604

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	Activity Code:
	LINDSAY LIGHT- 465 N. PARK	

SAMPLERS: *(Print Name and Sign)*
ADAM PETERCA / Adam J. Peterca

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Analyte: HPBe	(3-DAY) SOIL MOISTURE					TAG NUMBERS
1	6/15/17	1225	X		LL-170615-AFV	1	X						57539
2	6/15/17	1225	X		LL-170615-AFV-M	1		X					
3	6/15/17	1233	X		LL-170615-BW	1	X						57540
4	6/15/17	1233	X		LL-170615-BW-M	1		X					

6/16/17

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Adam J. Peterca	6/15/2017 1700	6/16/17 950
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)* / Date / Time

Ship To: ALS FORT COLLINS
225 COMMERCE DR.
FORT COLLINS, CO 80524

ATTN:

Airbill Number
7325 2029 8071

Chain of Custody Seal Numbers
57541; 57542

5 of 164

Distribution: White - Accompanies Shipment; Pink - Coordinator Field Files; Yellow - Laboratory File

5-63675

ALS Environmental - Fort Collins
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: TETRA TECH Workorder No: 1706376

Project Manager: MH Initials: JNS Date: 6/16/17

1. Does this project require any special handling in addition to standard ALS procedures?		YES	(NO)
2. Are custody seals on shipping containers intact?	NONE	(YES)	NO
3. Are Custody seals on sample containers intact?	NONE	(YES)	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		(YES)	NO
5. Are the COC and bottle labels complete and legible?		(YES)	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		(YES)	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	(YES)	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	(N/A)	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	(N/A)	YES	NO
10. Is there sufficient sample for the requested analyses?		(YES)	NO
11. Were all samples placed in the proper containers for the requested analyses?		(YES)	NO
12. Are all samples within holding times for the requested analyses?		(YES)	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		(YES)	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	(N/A)	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ____ dusting ____ moderate ____ heavy	(N/A)	YES	NO
16. Were the samples shipped on ice?		YES	(NO)
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	RAD ONLY	YES	(NO)

Cooler #:	1							
Temperature (°C):	amb.							
No. of custody seals on cooler:	2							
DOT Survey/ Acceptance Information: External µR/hr reading:	10							
Background µR/hr reading:	10							

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? (YES) / NO / NA (If no, see Form 008.)

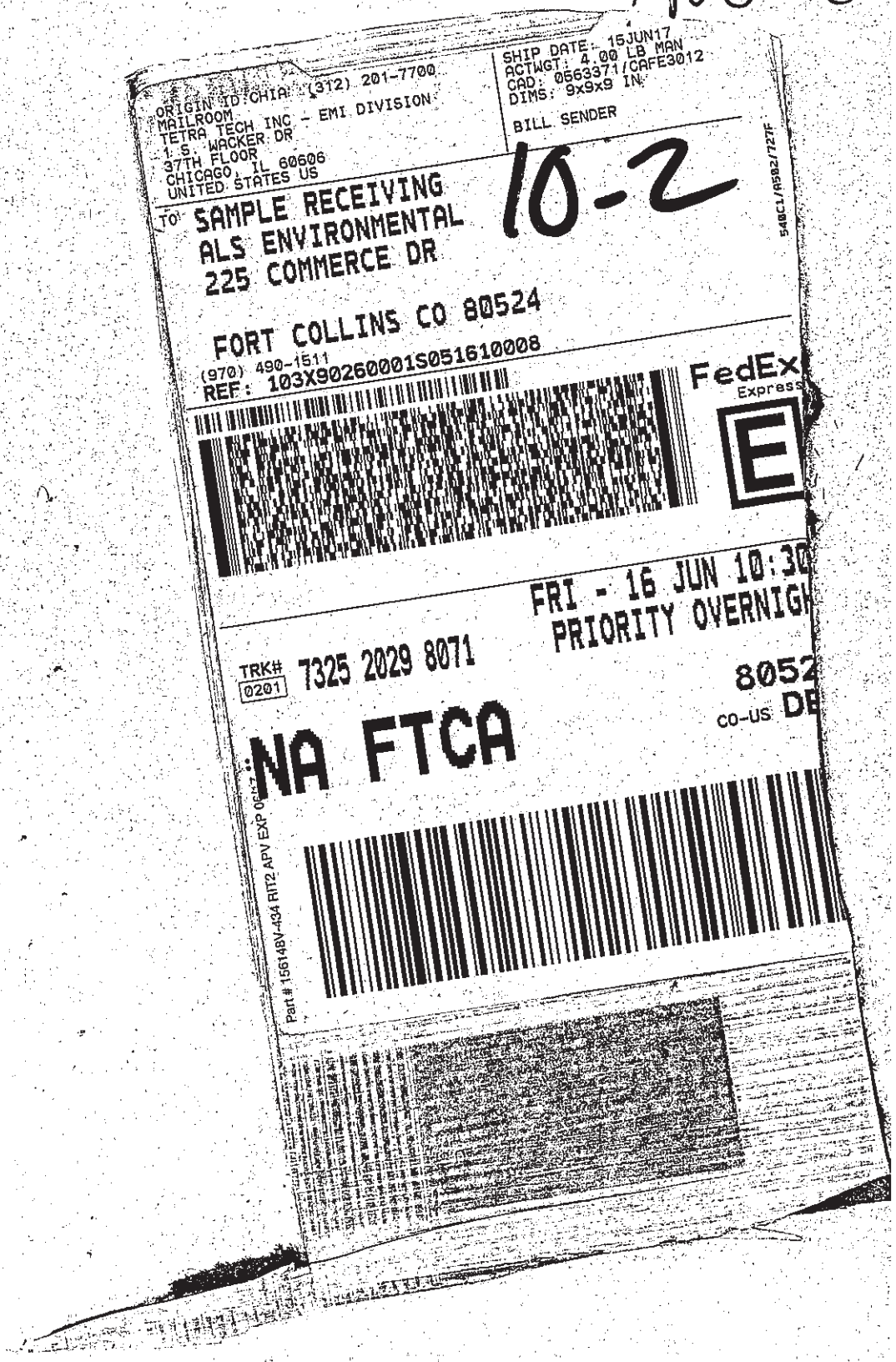
Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

If applicable, was the client contacted? YES / (NO) / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: 6-16-17

*IR Gun #2: Oakton, SN 29922500201-0066
*IR Gun #4: Oakton, SN 2372220101-0002

1706376


ORIGIN ID:CHIA (312) 201-7700
MAILROOM
TETRA TECH INC - EMI DIVISION
1 S. WACKER DR
37TH FLOOR
CHICAGO, IL 60606
UNITED STATES US
SHIP DATE: 15JUN17
ACTWGT: 4.00 LB MAN
CAD: 0563371/CAFE3012
DIMS: 9x9x9 IN
BILL SENDER
TO SAMPLE RECEIVING
ALS ENVIRONMENTAL
225 COMMERCE DR
10-2
FORT COLLINS CO 80524
(970) 490-1511
REF: 103X90260001S051610008
FedEx
Express
FRI - 16 JUN 10:30
PRIORITY OVERNIGH
TRK# 0201 7325 2029 8071
8052
CO-US DE
NA FTCA
Part # 156148V-434 RIT2 APV EXP 06

Section 2

2

SAMPLE RESULTS SUMMARY

Due to the nature of gamma spectroscopy data, a summary report is not provided.

Please refer to the individual sample results in Section 4.

Section 3

QC RESULTS SUMMARY 3

Gamma Spectroscopy Results

PAI 713 Rev 14

Method Blank Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Lab ID: GS170616-1MB

Library: NATURAL.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 16-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes

Final Aliquot: 500 g
Result Units: pCi/g
File Name: 170688d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14331-83-0	Ac-228	0.042 +/- 0.025	0.039	1	NA	NQ
14913-49-6	Bi-212	0.009 +/- 0.087	0.148	1	NA	U
14733-03-0	Bi-214	0.016 +/- 0.013	0.022	1	NA	U
13966-00-2	K-40	-0.40 +/- 0.25	0.42	2	NA	U
15100-28-4	Pa-234m	-0.05 +/- 0.99	1.70	35	NA	U
15092-94-1	Pb-212	-0.001 +/- 0.018	0.029	1	NA	U
15067-28-4	Pb-214	-0.006 +/- 0.026	0.043	1	NA	U
15262-20-1	Ra-228	0.042 +/- 0.025	0.039	1	NA	NQ
14274-82-9	Th-228	0.042 +/- 0.025	0.039	1	NA	NQ
15065-10-8	Th-234	0.194 +/- 0.092	0.140	2	NA	NQ
14913-50-9	Tl-208	0.0099 +/- 0.0062	0.0097	1	NA	NQ

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP
U
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Method Blank Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Lab ID: GS170616-1MB
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 16-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes

Final Aliquot: 500 g
Result Units: pCi/g
File Name: 170688d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.009 +/- 0.012	0.020	1	NA	U,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP
U
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Lab ID: GS170616-1LCS

Library: ANALYTICAL.LI

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 16-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 18-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 30 minutes

Final Aliquot: 500 g
Result Units: pCi/g
File Name: 170682d01

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14596-10-2	Am-241	212 +/- 26	8	201.7	105	85 - 115	P
10198-40-0	Co-60	95 +/- 11	0	90.78	104	85 - 115	P
10045-97-3	Cs-137	83.1 +/- 9.8	0.6	78.26	106	85 - 115	P

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP
LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1DUP

Library: NATURAL.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170260d02

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
14331-83-0	Ac-228	0.534 +/- 0.083	0.113	LT,G,J	0.537 +/- 0.078	0.097	LT,G,J	0.0227	2.13
14913-49-6	Bi-212	0.51 +/- 0.18	0.25	LT,G,J	0.54 +/- 0.13	0.17	LT,G	0.175	2.13
14733-03-0	Bi-214	0.456 +/- 0.069	0.066	LT,G,J	0.36 +/- 0.12	0.20	LT,G,J	0.648	2.13
13966-00-2	K-40	7.8 +/- 1.0	0.6	G,J	8.0 +/- 1.0	0.4	G	0.199	2.13
15100-28-4	Pa-234m	-0.2 +/- 1.7	3.0	U,G,J	0.6 +/- 1.5	2.4	U,G,J	0.375	2.13
15092-94-1	Pb-212	0.595 +/- 0.077	0.046	LT,G,J	0.568 +/- 0.074	0.048	LT,G,J	0.252	2.13
15067-28-4	Pb-214	0.452 +/- 0.061	0.053	LT,G,J	0.445 +/- 0.062	0.051	LT,G,J	0.0724	2.13
15262-20-1	Ra-228	0.534 +/- 0.083	0.113	LT,G,J	0.537 +/- 0.078	0.097	LT,G,J	0.0227	2.13
14274-82-9	Th-228	0.534 +/- 0.083	0.113	LT,G,J	0.537 +/- 0.078	0.097	LT,G,J	0.0227	2.13
15065-10-8	Th-234	0.50 +/- 0.42	0.67	U,G,J	0.67 +/- 0.40	0.64	LT,G,TI,J	0.303	2.13
14913-50-9	Tl-208	0.188 +/- 0.030	0.030	LT,G,J	0.159 +/- 0.026	0.029	LT,G,J	0.733	2.13

Comments:

Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
DER - Duplicate Error Ratio
BDL - Below Detection Limit
NR - Not Reported

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1DUP

Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170260d02A

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
13982-63-3	Ra-226	0.452 +/- 0.060	0.053	LT,G,J	0.439 +/- 0.061	0.051	LT,G,J	0.153	2.13

Comments:

Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13
LT - Result is less than Request MDC, greater than sample specific MDC
M - Requested MDC not met.
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
L - LCS Recovery below lower control limit.
H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.
N - Matrix Spike Recovery outside control limits
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
DER - Duplicate Error Ratio
BDL - Below Detection Limit
NR - Not Reported

Data Package ID: *GSS1706376-1*

Section 4

INDIVIDUAL SAMPLE RESULTS

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1
Library: NATURAL.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 18-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170683d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14331-83-0	Ac-228	0.534 +/- 0.083	0.113	1	NA	LT,G,J
14913-49-6	Bi-212	0.51 +/- 0.18	0.25	1	NA	LT,G,J
14733-03-0	Bi-214	0.456 +/- 0.069	0.066	1	NA	LT,G,J
13966-00-2	K-40	7.8 +/- 1.0	0.6	2	NA	G,J
15100-28-4	Pa-234m	-0.2 +/- 1.7	3.0	35	NA	U,G,J
15092-94-1	Pb-212	0.595 +/- 0.077	0.046	1	NA	LT,G,J
15067-28-4	Pb-214	0.452 +/- 0.061	0.053	1	NA	LT,G,J
15262-20-1	Ra-228	0.534 +/- 0.083	0.113	1	NA	LT,G,J
14274-82-9	Th-228	0.534 +/- 0.083	0.113	1	NA	LT,G,J
15065-10-8	Th-234	0.50 +/- 0.42	0.67	2	NA	U,G,J
14913-50-9	Tl-208	0.188 +/- 0.030	0.030	1	NA	LT,G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 18-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170683d01A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.452 +/- 0.060	0.053	1	NA	LT,G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Duplicate Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1DUP
Library: NATURAL.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170260d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14331-83-0	Ac-228	0.537 +/- 0.078	0.097	1	NA	LT,G,J
14913-49-6	Bi-212	0.54 +/- 0.13	0.17	1	NA	LT,G
14733-03-0	Bi-214	0.36 +/- 0.12	0.20	1	NA	LT,G,J
13966-00-2	K-40	8.0 +/- 1.0	0.4	2	NA	G
15100-28-4	Pa-234m	0.6 +/- 1.5	2.4	35	NA	U,G,J
15092-94-1	Pb-212	0.568 +/- 0.074	0.048	1	NA	LT,G,J
15067-28-4	Pb-214	0.445 +/- 0.062	0.051	1	NA	LT,G,J
15262-20-1	Ra-228	0.537 +/- 0.078	0.097	1	NA	LT,G,J
14274-82-9	Th-228	0.537 +/- 0.078	0.097	1	NA	LT,G,J
15065-10-8	Th-234	0.67 +/- 0.40	0.64	2	NA	LT,G,TI,J
14913-50-9	Tl-208	0.159 +/- 0.026	0.029	1	NA	LT,G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Sample specific Minimum Detectable Concentration
BDL - Below Detection Limit
DL - Decision Level

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Duplicate Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-AFV
Lab ID: 1706376-1DUP
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 19-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 418 g
Prep Basis: As Received
Moisture(%): 11.207
Result Units: pCi/g
File Name: 170260d02A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.439 +/- 0.061	0.051	1	NA	LT,G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.
G - Sample density differs by more than 15% of LCS density.

Abbreviations:
TPU - Total Propagated Uncertainty
MDC - Sample specific Minimum Detectable Concentration
BDL - Below Detection Limit
DL - Decision Level

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-BW
Lab ID: 1706376-2
Library: NATURAL.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 18-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 355 g
Prep Basis: As Received
Moisture(%): 10.962
Result Units: pCi/g
File Name: 170257d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14331-83-0	Ac-228	11.6 +/- 1.4	0.1	1	NA	G,J
14913-49-6	Bi-212	11.6 +/- 1.4	0.5	1	NA	G,J
14733-03-0	Bi-214	1.95 +/- 0.24	0.10	1	NA	G,J
13966-00-2	K-40	7.70 +/- 0.98	0.48	2	NA	G,J
15100-28-4	Pa-234m	3.3 +/- 1.9	2.9	35	NA	LT,G,J
15092-94-1	Pb-212	11.6 +/- 1.4	0.1	1	NA	G,J
15067-28-4	Pb-214	2.02 +/- 0.24	0.08	1	NA	G,J
15262-20-1	Ra-228	11.6 +/- 1.4	0.1	1	NA	G,J
14274-82-9	Th-228	11.6 +/- 1.4	0.1	1	NA	G,J
15065-10-8	Th-234	9.2 +/- 1.3	1.2	2	NA	G,TI,J
14913-50-9	Tl-208	3.57 +/- 0.42	0.05	1	NA	G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: *GSS1706376-1*

Gamma Spectroscopy Results

PAI 713 Rev 14

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706376
Client Name: Tetra Tech, Inc.
ClientProject ID: Lindsay Light - 465 N. Park

Field ID: LL-170615-BW
Lab ID: 1706376-2
Library: RA226.LIB

Sample Matrix: SOIL
Prep SOP: PAI 739 Rev 12
Date Collected: 15-Jun-17
Date Prepared: 16-Jun-17
Date Analyzed: 18-Jun-17

Prep Batch: GS170616-1
QCBatchID: GS170616-1-1
Run ID: GS170616-1A
Count Time: 1000 minutes
Report Basis: Dry Weight

Final Aliquot: 355 g
Prep Basis: As Received
Moisture(%): 10.962
Result Units: pCi/g
File Name: 170257d02A

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.98 +/- 0.24	0.08	1	NA	G,J

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: *GSS1706376-1*

Section 5

RAW DATA

Remaining section not included in
Letter Report because of large file size

5

HEALTH PHYSICS DATA

Stan A. Huber Consultants, Inc.

RADIATION SURVEY FORM

SURVEY REFERENCE #: **AECOM – 465 N. Park Dr. (CET Exclusion Zone Bag Survey)**

DATE OF SURVEY: **6/15/17 (analysis 6/16/17)**

NAME OF SURVEYOR: **Glenn Huber**

SURVEY METER IDENTIFICATION: Mfg: **Bicron**

Background Reading: **3 uRem/hr** Model: **MicroRem**

Serial: **C258C**

INSTRUMENT ID: Mfg: **Ludlum**

Background Reading: **0.28 cpm** Model: **2200 (scaler) / 43-10 (alpha)**

Efficiency: **39.7 %** Serial: **130520 / PR 119038**

MDA: **6.57 dpm**

Description (attached sketch if needed) (Area, equipment, vehicle, materials, etc.)	Item #	Survey Gross uRem	Smear Gross Cpm 2 min Ct / Gross CPM		dpm per 100 sq. cm
1 Soil Bag (1/2 filled) – Bags Surveyed Individually, not yet placed into a truck		**See below**			
Bag CET-1 – wipe 1		**9**	**0**	**0**	**<6.57 dpm**
Bag CET-1 – wipe 2			**2**	**1**	**<6.57 dpm**
Notes:					
No Field Gamma Spec Sample Collected;					
Bag Sample Sent to RSSI for Analysis.					
Excavated Soil = 7.2 kcpm-42 kcpm					

Stan A. Huber Consultants, Inc.

RADIATION SURVEY FORM

SURVEY REFERENCE #: **AECOM – 465 N. Park Dr. (CET Exclusion Zone Equipment)**

DATE OF SURVEY: **6/15/17 (Analysis 6/16/17)**

NAME OF SURVEYOR: **Glenn Huber**

SURVEY METER IDENTIFICATION: Mfg: **Ludlum**

Background Reading: **60 cpm** Model: **14C**

Serial: **114750**

INSTRUMENT ID: Mfg: **Ludlum**

Background Reading: **0.28 cpm** Model: **2200 (scaler) / 43-10 (alpha)**

Efficiency: **39.7 %** Serial: **130520 / PR 119038**

MDA: **6.57 dpm**

Description (attached sketch if needed) (Area, equipment, vehicle, materials, etc.)	Item #	Survey Gross cpm	Gross Cpm 2 min Ct / Gross CPM		dpm per 100 sq. cm
Backhoe					
Bucket Outside		**<100**	**0**	**0**	**<6.57 dpm**
Bucket Inside		**<100**	**3**	**1.5**	**<6.57 dpm**
Left Tread		**<100**	**0**	**0**	**<6.57 dpm**
Right Tread		**<100**	**1**	**0.5**	**<6.57 dpm**

Area Air Monitoring Summary Sheet - Staplex High Volume Pumps (Daily Analysis)

AECOM - 465 N. Park Dr.

Report No. 1 June 15, 2017: Cleanup of CET-1 Exclusion Zone

					day after analysis							four day analysis							% of Limit
Sample ID	date sampled	total time sampled	cubic ft/ min (CFM)	sample volume analyzed	date analyzed	gross counts	gross cpm	bkg cpm	net cpm	eff	Concentration in uCi/ml	date analyzed	gross counts	gross cpm	bkg cpm	net cpm	eff	Concentration in uCi/ml	4.00E-15 Th-232 uCi/ml
S001	6/15/17	105	67	6.97E+06	06/16/17	50	1.67	0.28	1.39	0.397	6.45E-14	06/19/17	9	0.30	0.34	0.00	0.398	0.00E+00	0.00%

Start: 9:32am 70 CFM
End: 11:17am 65 CFM

Personal Air Monitoring Summary Sheet (PAM's -Daily Analysis)

465 N. Park Dr., Chicago, IL AECOM

Report No. 1 6/15/17

Cleanup of CET-1 Exclusion Zone

						day after analysis							four day analysis						
Date Collected	Init	Sample ID	Flow Rate (lpm)	Total Time Sampled	Total Sample Volume (ml)	Analysis Date	Gross Counts (30 min)	Gross CPM	Bkg CPM	Net CPM	eff	Sample Concentration (uCi/ml)	Analysis Date	Gross Counts (30 min)	Gross CPM	Bkg CPM	Net CPM	eff	Sample Concentration (uCi/ml)
6/15/17	GH	PAM001	2.5	67	1.68E+05	06/16/17	8	0.27	0.28	0.00	0.397	0.00E+00	No 4 day analysis required						

pump 20160307073

start 10:05am , stop 11:12am = 2.5 CFM 6/15/2017

*****Note: Samples with counts greater than background on day after analysis are analyzed again after 4 days to allow for radon / thoron progeny decay**

Occupational Dose Limit for Occupational Radiation Exposure = 5 rem Total Effective Dose Equivalent
2000 DAC-Hours = 5 rem
DAC (Derived Air Concentration) for Th-232 = 5E-13uCi/ml
Administrative Site Limit for Occupational Exposure = 30% Th-232 DAC = 1.5E-13 uCi/ml