

May 8, 2020

Ms. Betsy Ulrich
Mail Control No. 618165
USNRC, Region 1
Division of Nuclear Materials Safety
2100 Renaissance Blvd.
King of Prussia, PA 19406

Dear Ms. Ulrich:

AECOM is please to provide the following responses to the USNRC's requests for additional information (RAIs) originating from our license application dated February 10, 2020. Attached is a restatement of the USNRC's RAIs and the AECOM responses. AECOM is also providing a copy of the signed Form 313, a revised file providing Supplemental Information for Items 5 through 11, and five additional supporting documents as requested in the RAIs. Should you require any additional information, please contact Kevin Taylor at (864) 234-3005 or kevin.taylor@aecom.com or Denny Jorgenson at (402) 952-2546 or denny.jorgensone@aecom.com.

Regards,



Kevin E. Taylor, CHP
Manager, Radiological Services

Enclosures

RAIs and RAI Responses
NRC Form 313
Supplemental Information for NRC Form 313
RS-TPG-SOP 019, Air Particulate Sample Collection
RS-TPG-SOP 026, Accidents and Emergencies Procedure
WI-001, Work Instruction: Delineation Drilling and Gamma Logging
WI-002, Work Instruction: Radiological Air Monitoring, Exposure Rate and Soil Screening Surveys
WI-003, Work Instruction: TERRASYNC, Basis usage for Radiological Survey Logging

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

- 1) RAI: Confirm the name of the licensee to be listed on the license. Also, please state if you hold other licenses under either NRC or Agreement State jurisdiction, because we identified currently active licenses issued by the NRC under similar names (AECOM Technical Services, or AECOM Technical Services, Inc., or AECOM Technical Services of Michigan).

Response: AECOM has added "Inc." to its name on the license application dated February 10, 2020 so that the name that the company name will appear on the license as "AECOM Technical Services, Inc." AECOM can confirm we possess several NRC and state radioactive licenses under various corporate names including two licenses that are still held under the name of a legacy company purchased by AECOM in 2017 (URS Corporation). A list of those licenses is provided below.

State Issuing License or Registration	License/Regis #	Name of Company Exactly as it Appears on License	License Allowed Equipment and Quantity	Notes
Alabama	AL Dept. Of Public Health #1254	AECOM	5 Troxler and 2 CPN Gauges Max	Pending name change to AECOM Technical Services, Inc.
California	State of California Radiological Health Branch #4393-19	AECOM Technical Services, Inc. dba AECOM	Max 9 Troxler and 1 CPN Gauges- 9 total max; 3 XRF	
	State of California Radiological Health Branch #3518-43	U.R.S. Corporation	Troxler Gauges	
	State of California Radiological Health Branch South- # 2190-37	AECOM Technical Services, Inc.	Troxler Gauges	
	State of California Radiological Health Branch # 3049-38	AECOM Technical Services, Inc.	2 Troxler	
	State of California-Health and Human Services Agency 8104-30	AECOM	Various Quantities of Radioactive Materials owned or operated under the authority of various clients.	
	State of California-Health and Human Services Agency #8180-30	AECOM Technical Services, Inc.		
Florida	State of Florida Dept of Health #3198-1	URS Corporation Southern	32 Troxler Gauges AND 3 CPNs	Pending name change to AECOM Technical Services, Inc.

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

State Issuing License or Registration	License/Regis #	Name of Company Exactly as it Appears on License	License Allowed Equipment and Quantity	Notes
Hawaii	State of HI #X0124	AECOM Technical Services, Inc.	1 Niton XRF (allowed to be rented)	
Illinois	Illinois Emergency Management Agency (IEMA) #IL-01562-01	AECOM USA, Inc.	15 Troxler and 15 CPN Gauges Max	
Iowa	Iowa Dept Public Health #0322-1-07-PG	AECOM Technical Services	4 Troxler and 4 CPN Gauges Max	
Louisiana	Louisiana Dept. of Env. Quality # LA-3007-L01	URS Corporation	5 Troxler and 5 CPN Gauges Max; 3 XRF Max	
Maryland	Maryland Department of the Environment #MD-31-111-01	AECOM Technology Corporation	3 Troxler; 3 CPN	
Michigan (for IL office)	NRC #48-18672-01	AECOM Technical Services of Michigan, Inc.	3 Troxler and CPN Gauges	
Ohio	Ohio Dept. of Health #31210180083	AECOM Services of Ohio, Inc.	5 Troxler Gauges	
Pennsylvania	Penn. Dept. of Env. Protection #PA-1576	AECOM Technical Services, Inc.	4 Troxler Gauges	
Pennsylvania	NRC # 37-19654-01	AECOM Technical Services, Inc.	4 Troxler Gauges	
South Carolina	SC Dept. of Health & Env. Control #866	AECOM Technical Services, Inc.	Troxler & CPN gauges	
Utah	Utah Dept of Environmental Quality UT #1800596	AECOM Technical Services Inc.	5 Troxler	
Washington	Washington State Dept of Health #WN-10172-1	AECOM (URS Corporation)	Troxler and CPN Gauges (50 Max) and 2 Model MC series	
Wisconsin	State of WI Dept. of Health Services #009-1308-01	AECOM Technical Services, Inc.	Troxler and CPN Gauges	

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

- 2) RAI: In Section 5 of your application, you listed uranium-234 (U-234) as special nuclear material rather than source material. The NRC defines special nuclear material (SNM) as U-233, U-235 or any plutonium. Confirm if U-234 should be requested under the source material category. We confirm U-234 should be requested under the source material category.

Response: The table in Section 5 has been revised.

- 3) RAI: In Section 5 of your application, you requested very small quantities of materials. It appears that you may be limiting the types and quantities requested in order to eliminate the requirement to provide financial assurance (FA). Please note that the following license conditions are standard on licenses for site remediation services:

- The licensee does not take possession of the radioactive materials and/or sealed sources while at the customer's facility [insert as needed - for example "except for analytical samples"].
- Except for calibration sources, reference standards, and radioactively contaminated equipment owned by the licensee, receipt, storage, and use incidental to any activity of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.

These conditions limit the site remediation licenses to the use of the radioactive materials for activities authorized on the license at temporary job sites only, and do not authorize possession of the material other than calibration and check sources, or analytical samples. Therefore, you will not be required to provide financial assurance regardless of the license limits. Possession of the material remains under the financial assurance and other regulatory requirements of the site at which you are working. Confirm that you wish to be authorized only for the materials requested in the application or propose additional materials and quantities.

Response: Thank you for clarifying the financial assurance requirements. Given that financial assurance is (1) covered under the financial assurance requirements of the site at which AECOM will be working, or (2) not required until possession of radioactive materials at a temporary job site AECOM exceeds the financial assurance limits and there are no other financial assurance measures in place for the site. As such, AECOM has increased the possession limit request for byproduct materials to be equivalent to the possession limits under our California radioactive materials license. We have not adjusted limits for source material or special nuclear material. Please see the revised table under Section 5.

- 4) RAI: The authorized activities requested did not include the use of portable gauges. However, several procedures referred to training for gauge use, and transportation of portable gauges. Please confirm if portable gauge will be used under this license, or if the activities with portable gauges will be performed under another AECOM license. If activities with portable gauges will be authorized under this license, you need to request the materials and provide the information requested in NUREG-1556, Volume 1, Revision 2, "Consolidated Guidance About Materials Licenses Program-Specific Guidance About Portable Gauges." Please note that this activity falls under a different fee category and an additional fee will be assessed.

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

Response: Portable gauges will not be used under this license. As provided in the response to RAI #1, AECOM possess, uses, and transports gauge sources under other NRC and state licenses.

- 5) RAI: The activities and the materials requested in Item 5 are authorized under different program codes in two fee categories. The application fee for each fee category can be found in 10 CFR 170.31 and the annual fee in 10 CFR 171.16. NRC regulations may be found at <https://www.nrc.gov/reading-rm/doc-collections/cfr/>. Your total fees will be the sum of all fee categories.

For each of the following, confirm that you do, or do not, wish to be authorized for the materials and/or activity. Where applicable, provide the additional information requested.

- Program code 03219 is applicable to site characterization surveys and sampling; decontamination, decommissioning and remediation of facilities, grounds and equipment decontamination services (described as 'decontamination and decommissioning services' in NUREG-1556, Vol. 18., rev.1), under fee category 3.N. This program code applies only to byproduct material, so activities with source and special nuclear material would fall under separate program codes and fee categories.
- The source material you requested falls under program code 11300, source material, other, more than 150 kilograms. This is in fee category 2.F.

Response: AECOM will not possess source material in excess of 150 kilograms. As such, we do not wish to be licensed under program code 11300.

- 6) RAI: Item 6 refers to solidification and stabilization of waste at temporary locations. If you plan to perform such waste treatment as a service for customers separately from decontamination and decommissioning services, these activities could be in several program codes, all of which include byproduct and source materials (03232, waste disposal service, prepackaged only in fee category 4.C.; 03234 waste disposal service, processing and/or repackaging, in fee category 4.B; 03233 waste disposal service, incineration and 03236 waste treatment service other than compaction, both in fee category 4.A.)

Based on your application, it appears that you plan to handle only wastes generated by the decontamination and decommissioning activities you perform for a customer. If this is correct, please state, "We will limit waste handling activities to those wastes generate by decontamination and decommissioning services we provide. We will NOT take possession of waste generated by the customer as would a commercial waste service provider, or handle wastes we did not generate."

If this is not correct, please describe the specific waste service(s) you are providing associated with handling customer's waste. NUREG-1556, Vol. 18, Rev. 1 describes commercial waste management to include activities such as incineration, compaction, solidification, vitrification, packaging, repackaging, or transportation of waste for customers. Provide a statement that: "We will use the model waste procedures published in Appendix M of NUREG– 556, Volume 18, Revision 1, 'Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Service Provider Licenses,' or provide the procedures for each commercial waste service you will be providing at customer facilities.

Response: AECOM removed the following bullet from Item 6 of the Supplemental Information for NRC For 313: "Solidification and stabilization of waste at temporary locations," and added the following, "*AECOM will limit waste handling activities to those wastes generate by decontamination and decommissioning services we provide. We will NOT take possession of waste generated by the customer as would a commercial waste service provider, or handle wastes we did not generate.*"

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

- 7) RAI: Authorized users proposed in the application are Stephen Shafer and Christopher Higgins, and the RSO, Kevin Taylor. Your procedures primarily refer to Authorized Users in the context of portable gauge users, and site RSOs as those implementing the Radiation Protection Programs (RPP) and being responsible for project radiation safety. Specifically, "The Site RSO receives radiation safety technical guidance from the AECOM Business Group RSO." In accordance with NUREG 1556, Volume 18, "Program Specific Guidance About Service Provider Licenses," Revision 1 (NUREG 1556, Vol. 18, Rev. 1), Section 8.7.1, "Radiation Safety Officer," please provide the following:
- a. An explanation of the roles and responsibilities of the authorized users (those named above to be listed on the license) at the temporary job sites for site remediation activities. Explain the relationship between RSO to be listed on the license, the Business Group RSO, the license/site RSO, the License/Program/Site, and the authorized users.
 - b. Confirmation that the RSO will be available for emergencies and can be on-site at temporary job sites within 24-48 hours, if applicable.
 - c. Demonstration that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart by position and demonstrating day-to-day oversight of the radiation safety activities.

Response: Additional information was added to Item 7 of the Supplemental Information for NRC For 313 to provide the required information.

- 8) RAI: The application states, "Emergency procedure for a project or program shall be provided in or referenced in the applicable RPP." In accordance with NUREG 1556, Vol. 18, Rev.1, Section 8.10.1 "Operating and Emergency Procedures," please submit a description of your emergency procedures for radiological conditions that might be encountered as part of your license application. The description does not have to be at the level of detail in an RPP but should be sufficient to understand the types of emergencies that could occur and your actions for such emergencies.

Response: AECOM is providing the NRC with a copy of its Accident and Emergencies Procedure (RS-TPG-SOP026). This procedure is consistent with NUREG 1556, Vol. 18, Rev.1, Section 8.10.1 "Operating and Emergency Procedures."

- 9) RAI: Please provide more specific information regarding the types of activities you expect to perform related to site characterization, decontamination and decommissioning of facilities. In particular, Item 6 described activities to include remediation of groundwater, process water, soil and soil-like materials but did not include procedures for such activities.
- o Specify if procedures will be limited to surveys and routine cleaning activities of indoor facilities and equipment, or if you expect to use aggressive methods that could include grinding, cutting, scabbling or other activities that could generate airborne radioactivity; chemical methods that could result in generation of mixed wastes; or other methods that could require use of specialized protective clothing or equipment such as respirators. If more aggressive procedures will be used, please provide them. If such procedures are site-specific, provide example procedures used on sites where such activities were performed.
 - o Specify if you will be performing remediation activities in outdoor areas. One of your procedures referred to moving soil or digging soil. Specify if activities outdoors will be limited to surveys and limited soil sampling in the top 15 centimeters, or if you expect to perform activities such as core sampling, soil removal, sampling and remediation below 15 centimeters, ground water and surface water sampling, or other similar activities that may

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

require additional radiation or other safety precautions. If such procedures are site-specific, provide example procedures used on sites where such activities were performed.

Response: In most cases, AECOM will be conducting site characterization and remediation/decommissioning support activities that are focused on data collection. AECOM anticipates collecting environmental samples from multiple media including surface soils, subsurface soil, sediments, surface water, groundwater, and potentially flora and fauna. AECOM will also conduct radiation surveys over land areas and in structures to assess radiation/contamination levels. Samples from building or other surface may include removal contamination samples (smears) and building material samples (e.g., concrete cores). AECOM will generally use off-site laboratories for sample analysis, but we do have internal capabilities for total alpha/beta counting of smears and field gamma spectroscopy.

Most outdoor remediation services involving radioactive materials will consist of soil excavation, packaging, and transportation. However, AECOM may implement its license in support of groundwater or process water treatment/filtering activities that could generate radioactive filters or process resins. A water source may also include decontamination water that is collected and filtered. Releases of any water to the environment or waste water systems will be detailed in project-specific effluent discharge and sampling and analysis plans and all releases will meet the most limiting of regulatory release limits or site discharge permit requirements.

AECOM may also collect air samples to either demonstrate that environmental release limits are not being exceeded from site operations or to assess exposures to airborne radioactivity during soil sampling and excavation tasks. Other safety monitoring may include external dose monitoring with standard or electronic dosimeters and radon monitoring. AECOM is providing the NRC with a copy of its general air sampling procedure (RS-TPG-SOP019, Rev. 1). To provide additional guidance to field staff, RS-TPG-SOP019 can be supplemented with site and field specific work instructions on equipment operation, placement of air samplers, etc. Additional sampling and monitoring requirements, such as those that would be implemented during subsurface soil sampling in a potentially contaminated area, are described Work Plans, Radiation Work Permit (RWPs), or in in site-specific work instructions such as WI-001: Work Instruction Delineation Drilling and Gamma Logging and WS-002: Monitoring Work Instruction Borehole Air Monitoring (WI-001 and WI-002 are being provided to the NRC).

When performing outdoor remediation work in potentially contaminated areas outside the work area will be protected through implementation of site-specific Environmental Protection and Erosion Control Plans and procedures. These plans will focus on erosion and sediment control and stormwater management with locations and barriers identified on a site specific plan.

For decontamination activities, AECOM's scope of work will generally not include aggressive decontamination efforts such as grinding, cutting, scabbling or other activities that could generate airborne radioactivity; chemical methods that could result in generation of mixed wastes; or other methods that could require use of specialized protective clothing or equipment such as respirators. AECOM's Radiological Services Group has not performed these types of decontamination efforts in more than 10 years. If such activities were needed at a temporary job site, AECOM would use qualified subcontractors with existing operational and safety procedures to execute the work. Such work would be described in detailed work plans and site specific radiological and health and safety documentation.

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

- 10) Item 9 contains information about proposed facilities and equipment. Note that NUREG-1556, Volume 18, Section 9 states that equipment used at temporary job sites will be discussed in Section 8.10.1 "Operating and Emergency Procedures." RS-TPG SOP 010 identifies equipment including:
- Appropriate LLRW containers
 - Container labels
 - Packaging materials
 - Radioactive waste bags
 - Swipes
 - Removable contamination sample counter
 - Micro-R meter
 - Surface contamination meter (Ludlum Model 3/Ludlum 44-9 GM-Pancake)
 - Detector or Ludlum Model 2360/Ludlum 43-93 Alpha/Beta Scintillation Detector or equivalent

We note that some of the procedures refer to work that involves remediation of contaminated water or soils, waste stabilization, use of portable gauges, moving soil or digging. Please specify if any additional special equipment will be needed for such activities, or for aggressive remediation activities indoors or outdoors, as described in the previous item.

Response: As provided in the response to previous questions above, AECOM will not perform waste stabilization or solidification or use portable gauges under this license. Site characterization, remediation, and decontamination limitations are also discussed above (e.g., no self-performance of aggressive decontamination). As such, AECOM will not require the need for any additional specialty equipment other than the types of equipment previously mentioned when performing work tasks at temporary job sites under this license. However, more sophisticated radiation detectors and monitoring systems may be used on project sites (e.g., floor monitoring systems, GPS-enabled data loggers, and in situ gamma spectroscopy). Use of specialty equipment will be described in site-specific procedures or work instruction such as WI-003: GPS Radiological Survey. Air sampling equipment is discussed in RS-TPG-SOP019.

One exception could be the use of pumps and filters if tasks involved activities such as dewatering excavations or filtering decontamination water. This equipment would be selected specifically for the tasks for which it is required.

- 11) RAI: The SOP "License/Site Radiation Protection Program", Attachment 3, contains a table "ANSI/HPS N13.12-2013, Table 1 Screening levels for clearance." Please confirm that you understand that the NRC does not accept these screening levels for clearance of materials. The NRC published screening values for building surfaces and soil which may be used to meet license termination criteria. Release criteria other than the NRC screening criteria must be approved by the NRC prior to implementation. Confirm that you or your client in NRC jurisdiction will use NRC screening values for license termination or release of facilities; or will amend the client's license to obtain approval for alternate criteria for release of facilities, or release of volumetrically contaminated materials.

Response: AECOM confirms its understanding that the NRC does not accept ANSI/HPS N13.12-2013, Table 1 screening levels for clearance of materials. The NRC published screening values for building surfaces and soil which may be used to meet license termination criteria in NUREG-1757. Release criteria other than the NRC screening criteria must be approved by the NRC prior to implementation. When implementing our license in NRC jurisdiction, AECOM will use NRC screening values for license termination or release of facilities. For release of materials from radiological controlled areas, AECOM will use "non-detectable" as the release criterion. Survey methods and detection limits will be established with consideration of the more limiting of ANSI/HPS N13.12-2013, Table 1 values or NUREG-1757 values.

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

- 12) RAI: Please note that the following is a standard condition for site remediation service providers, which will be placed on your license. The limits requested in your application to not exceed those in the regulations for which emergency plans are required. No response to this item is required.

Notwithstanding the requirements in 10 CFR 30.32(i), 40.31(j), and 70.22(i), the licensee is not required to establish an emergency plan. Before taking possession of licensed material at a temporary job site in quantities requiring an emergency plan, the licensee shall either:

- a) Obtain U.S. Nuclear Regulatory Commission approval of an evaluation demonstrating that an emergency plan is not required pursuant to 10 CFR [30.32(i), 40.31(j), and 70.22(i)], or*
- b) Submit written confirmation to the U.S. Nuclear Regulatory Commission in accordance with Appendix D of 10 CFR part 20, that licensee personnel have been trained and will follow the provisions of an existing emergency plan approved by the U.S. Nuclear Regulatory Commission or an Agreement State for the temporary job site.*

Response: AECOM acknowledges the NRC's standard condition on the requirements for emergency plans.

- 13) RAI: Please confirm that you will meet the requirements of the following standard license condition for site remediation service providers. This condition ensures that sites for which an environmental assessment is required will be identified appropriately.

- a. Except as provided for in paragraph B of this license condition, any activity performed by the licensee at a temporary job site related to site characterization or the decontamination and decommissioning of facilities, equipment, and containers, including any waste packaging incidental to these activities, must be performed in accordance with the customer licensee's NRC-approved decommissioning plan that pertains to that temporary job site.*
- b. If the customer licensee is not required to submit a decommissioning plan to the NRC and if the customer licensee's operations at a temporary job site have been limited to the use of: 1) small quantities of short-lived radioactive materials, or 2) radioactive materials in sealed sources provided there is no evidence of leakage of radioactive material from these sealed sources, then any activity performed by the licensee at that temporary job site related to site characterization or the decontamination and decommissioning of facilities, equipment, and containers, including any waste packaging incidental to these activities, must be performed in accordance with the licensee's decommissioning procedures approved by the NRC under this license.*
- c. Any activity proposed to be performed by the licensee at a temporary job site that is not covered by either paragraph A or B of this license condition must be approved by the NRC through a site-specific license amendment or exemption request.*

Response: AECOM acknowledges that we will meet the standard license conditions as provided in RAI #13.

- 14) RAI: Confirm that you will obtain agreements as described in the following license condition which is standard for site remediation licenses:

This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the U.S. Nuclear Regulatory Commission or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision, and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall

**USNRC Requests for Additional Information to AECOM License Application Dated February 10, 2020
and AECOM Responses**

include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by license condition [insert number].

Response: AECOM acknowledges that we will obtain agreements with our customers who are also radioactive material license holders as described in the standard license conditions as provided in RAI #14.

15) RAI: Confirm that you will abide by the following license conditions that are standard for site remediation service providers:

- *The licensee shall notify the U.S. Nuclear Regulatory Commission in accordance with Appendix D of 10 CFR Part 20, in writing at least 14 days before initiating activities under this license at a temporary job site, excluding routine packaging or repackaging for purposes of transporting and not requiring a job or site specific work package, and characterization and/or final surveys where radioactive materials and/or radiation are not likely to be detected. This notification shall include: (1) The estimated type, quantity, and physical/chemical forms of licensed material to be used, (2) The specific site location, (3) A description of planned activities including waste management and disposition, (4) The estimated start date and completion date for the job, and (5) The name and title of a point of contact for the job, including information on how to contact the individual.*
- *Within 30 days of completing activities at each job site location, the licensee shall notify the U.S. Nuclear Regulatory Commission in accordance with Appendix D of 10 CFR Part 20, in writing, of the temporary job site status and the disposition of any licensed material used.*
- *The licensee shall maintain records of information important to decommissioning for each temporary job site pursuant to 10 CFR [30.35(g) and 40.36(f)]. The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.*
- *If approved by a Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the U.S. Nuclear Regulatory Commission Headquarters Operations Center at 301-816-5100 and the U.S. Nuclear Regulatory Commission Regional contact before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in Appendix D of 10 CFR Part 20.*

Response: AECOM acknowledges that we will abide by the standard license conditions as provided in RAI #15.

NRC FORM 313

(01-2020)
10 CFR 30, 32,
33, 34, 35, 36,
37, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR
MATERIALS LICENSE

APPROVED BY OMB: NO. 3150-0120

EXPIRES: 01/31/2023

Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Information Services Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE CURRENT VOLUMES OF THE NUREG-1556 TECHNICAL REPORT SERIES ("CONSOLIDATED GUIDANCE ABOUT MATERIALS LICENSES") FOR DETAILED INSTRUCTIONS FOR COMPLETING THIS FORM: <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/>. SEND TWO COPIES OF THE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

MATERIALS SAFETY LICENSING BRANCH
DIVISION OF MATERIAL SAFETY, STATE, TRIBAL AND RULEMAKING PROGRAMS
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA,
GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE,
NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO,
RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN
ISLANDS, OR WEST VIRGINIA,

SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND
APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

IF YOU ARE LOCATED IN:

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS,
LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH
DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS,
UTAH, WASHINGTON, OR WYOMING,

SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR (Check appropriate item)

- ☒ A. NEW LICENSE
☐ B. AMENDMENT TO LICENSE NUMBER _____
☐ C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT (Include zip code)

AECOM Technical Services, Inc.
10 Patewood Driver, Building 6, Suite 500
Greenville, SC 29615

3. ADDRESS WHERE LICENSED MATERIALS WILL BE USED OR POSSESSED

AECOM's license would be administered out of our
Greenville, SC office location identified above, We will not
permanently or temporarily store licenseable radioactive
materials at this location.

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Kevin E. Taylor, CHP, Manager, Radiological Services

BUSINESS TELEPHONE NUMBER

(864) 234-3005

BUSINESS CELLULAR TELEPHONE NUMBER

(864) 517-5639

BUSINESS E-MAIL ADDRESS

kevin.taylor@aecom.com

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL

- a. Element and mass number; b. chemical and/or physical form; and c. maximum amount
which will be possessed at any one time.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

10. RADIATION SAFETY PROGRAM.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

9. FACILITIES AND EQUIPMENT.

11. WASTE MANAGEMENT.

12. LICENSE FEES (Fees required only for new applications, with few exceptions*)

(See 10 CFR 170 and Section 170.31)

*Amendments/Renewals that increase the scope of the existing license to a new or higher fee category will require a fee.

FEE
CATEGORY

3N

AMOUNT
ENCLOSED \$

8,900.00

PER THE DEBT COLLECTION IMPROVEMENT ACT OF 1996 (PUBLIC LAW 104-134), YOU ARE REQUIRED TO PROVIDE YOUR TAXPAYER IDENTIFICATION NUMBER. PROVIDE THIS INFORMATION BY COMPLETING NRC FORM 531: <https://www.nrc.gov/reading-rm/doc-collections/forms/nrc531info.html>.

13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE

Denny Jorgenson / Senior Vice President

SIGNATURE

DATE

2-10-20

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			\$		
APPROVED BY				DATE	

NRC Form 313, Attachment 1 - Supplemental Information

AECOM Technical Services, Inc.

Item 5. Radioactive Material

Source Material		
Isotope	Form	Activity
Depleted Uranium	Present as contamination in soil or other media	0 mCi
Uranium-234		0 mCi
Uranium-238		10 mCi
Thorium-232		10 mCi
Other		0 mCi
Special Nuclear Material		
Uranium-235		0 mCi
Plutonium-238		0 mCi
Plutonium-239		0 mCi
Other		0 mCi
Byproduct Material		
Isotope	Form	Activity
Any byproduct material with atomic numbers 1-83	Any	5 Ci per radionuclide; total not to exceed 5 Ci
Any byproduct material with atomic numbers 84-104	Any	1 Ci per radionuclide; total not to exceed 1 Ci
Radium-226	Any	2 Ci
Americium-241	Any	2 Ci

Based on the activity limits requested for the radioisotopes listed in the table above and pursuant to 10 CFR 30.35, financial assurance is not required at this time. If AECOM requests an amendment to increase the license limits, AECOM will prepare a Decommissioning Funding Plan in accordance with 10 CFR 30.35(e) and financial assurance. AECOM will also keep records that are required, relevant and important to termination of the license after discontinuing the use of the license at temporary job site(s) where it is used. Records may include records of spills, waste storage areas or unusual occurrences involving the spread of contamination, records of remediation activities, and final status survey records will be maintained until license termination and then be transferred to the NRC in accordance with 10 CFR 30, 40, and 70, "Requirements for Disposition of Records Important to Decommissioning".

Item 6. Purpose(s) for which the Licensed Material Will be Used

- Decontamination, decommissioning and remediation of contaminated structures, equipment, materials ground water, process water, soil and soil-like materials (resins, media, sludges/ashes)
- Radiological scoping, process release for unrestricted use and/or final status surveys
- Site characterization
- Packaging for transportation
- Transportation by a licensed transporter in packages or containers approved for use under the provisions of 10 CFR part 71 for transfer to licensees authorized to receive the

NRC Form 313, Attachment 1 - Supplemental Information

AECOM Technical Services, Inc.

material in accordance with terms and conditions of licenses issued by the NRC or Agreement State

- Use of exempt check sources and reference standards for operational testing of radiation detection equipment
- Radiation protection or health physics training and instruction

AECOM will limit waste handling activities to those wastes generate by decontamination and decommissioning services we provide. We will not take possession of waste generated by the customer, as would a commercial waste service provider, or handle wastes we did not generate.

Item 7. Individual(s) Responsible for radiation Safety Program and Their Training and Experience

Radiation Safety Officer (RSO):

Kevin E. Taylor, Certified Health Physicist – see Attachment 2 for resume

Authorized Users (Site RSOs):

Stephen Shafer, Sr. Health Physicist – see Attachment 2 for resume

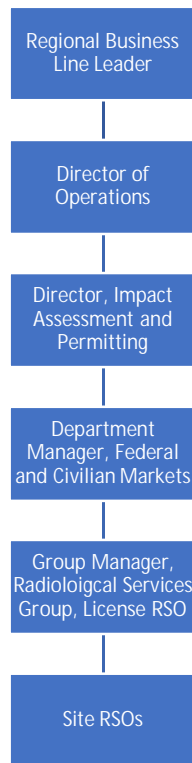
Christopher Higgins, Sr. Health Physicist – see Attachment 2 for resume

The Authorized Users, or Site RSOs, will have responsibility for radiation safety and license actions on temporary job sites. Each Site RSO reports to the License RSO in both the radiation safety structure of a project and organizationally. The License RSO is the manager of AECOM's Radiological Services Group and each Site RSO will be within the organization structure of the group reporting to the group manager. The License RSO will be available for emergencies and will be available to travel to temporary job sites with 24 to 48 hours after notification.

AECOM's Radiological Services Group lies within the Impact Assessment and Permitting practice of AECOM's Environment Business Line. The current Radiological Services Group manager reports through a Business Line organization chain. The organizational structure is summarized below.

NRC Form 313, Attachment 1 - Supplemental Information

AECOM Technical Services, Inc.



Item 8. Training for Individuals Working in or Frequenting Restricted Areas

The training requirements for those individuals that will work in or frequent restricted areas controlled under this license are provided in AECOM Radiological Services Technical Practice Group (RS-TPG) SOP 013, *Radiation Training*. RS-TPG SOP 013 is provided in Attachment 3.

Item 9. Facilities and Equipment

AECOM's license would be administered out of the AECOM Greenville, SCA office location identified above. AECOM will not permanently or temporarily store licensable radioactive materials at this location. The applicant will only possess radioactive materials at temporary job sites under the direct authority of this license or under reciprocity to a comparable regulatory state agency.

As a minimum, for the purpose of assessing worker exposure risks, radiation dose rate or gamma radiation exposure rate instruments will be present at any temporary job location. Contamination survey instruments [e.g., alpha/beta scintillation or Geiger-Muller (GM) detectors] will also be available when personnel are entering and exiting radiologically controlled areas. While AECOM maintains a small inventory of instruments, the majority of instrumentation will be rented on a job-by-job basis from RSO approved vendors. All instruments will be used in accordance with RS-TPG SOP 001, *Portable Detection Equipment*, and RS-TPG SOP 011, *Radiological Surveys*. AECOM trained personnel will use instruments that meet the radiation monitoring instruments specifications published in Appendix F of NUREG-1556, Volume 18, Revision 1, "Consolidated Guidance about Materials Licenses; Program Specific Guidance

NRC Form 313, Attachment 1 - Supplemental Information

AECOM Technical Services, Inc.

about Service Providers Licenses.” AECOM reserves the right to upgrade radiological survey instruments as necessary.

Item 10. Radiation Safety Program

AECOM's corporate commitment to radiation safety and ALARA policy is documented in the AECOM North American corporate safety program S3NA-120-PR1, *Radiation*. It is AECOM's policy to plan and conduct its radiological activities safely and in such a fashion as to protect the health and safety of its employees, subcontractors, members of the public, and the environment. To achieve this, AECOM shall confirm that efforts are taken to reduce radiological exposures and releases to the environment to as low as are reasonably achievable (ALARA), while taking into account social, technical, economic, practical and public policy considerations. AECOM's RS-TPG is committed to implementing this radiation protection program to reflect this policy.

Enclosed with this application are implementing standard operating procedures maintained by AECOM's Radiological Services Group that demonstrate a project-level commitment to radiation safety, ALARA and address specific items in the license application. The enclosed procedures (provided in Attachment 3) are summarized below with regard to license application information requests.



- RS-TPG SOP 001, *Portable Detection Equipment*. This procedure provides direction to AECOM personnel in the proper use and maintenance of radiation detection instruments that will most commonly be used at our temporary job sites. For specialized equipment, such as liquid scintillation counters, AECOM will develop site-specific procedures or operating instructions.
- RS-TPG SOP-003, *Dose Monitoring*. This procedure provides the requirements for implementing external and internal dose monitoring on temporary project sites. Instructions in the use of dosimeters are also provided.
- RS-TPG SOP 010, *Low-Level Radioactive Waste Management*, AECOM will not be the generator of record for any radioactive waste generated under its license, however this procedure provides project-level waste management practices.
- RS-TPG SOP 011, *Radiological Surveys*. This procedure provides general guidance to AECOM personnel conducting radiological surveys. For specialized surveys AECOM will develop RSO approved site-specific procedures, work instructions, or guidance.
- RS-TPG SOP 013, *Radiation Training*. AECOM will implement consistent and site-specific radiation safety training requirements as provided in the procedure.
- RS-TPG SOP 019, *Air Particulate Sample Collection*. This procedure provided instructions for air particulate sample collection for radiation safety of workers and the public during performance of work at temporary job sites.
- RS-TPG SOP 020, *License/Site Radiation Protection Program*. This procedure is an extension of AECOM's corporate Radiation Safety Program and implements AECOM ALARA Policy on the project level.
- RS-TPG SOP 026, *Accidents and Emergencies Procedure*. This procedure provides direction to field staff on emergency actions and reporting.

NRC Form 313, Attachment 1 - Supplemental Information

AECOM Technical Services, Inc.

Item 11. Waste Management

As AECOM will only use its license during contracted remediation or decommissioning activities and services at temporary job sites owned by our clients, AECOM will not be the generator of record for any radioactive waste generated under its license. While radioactive materials may be temporarily in the possession of AECOM under this license, our clients will be the owner and generator of the waste. However, RS-TPG SOP-010, *Low-Level radioactive Waste Management*, describes general project-level waste management practices that will be implemented for the safe management of low-level radioactive waste.

 <p>Radiological Service Technical Practice Group Standard Operating Procedure</p>	<p>PROCEDURE NO. <u>RS-TPG SOP 019, R1</u></p> <p>DATE: <u>December 16, 2019</u></p> <p>APPROVED: </p> <p>Radiological Service TPG Leader</p>
<p>Air Particulate Sample Collection</p>	

Standard Operating Procedure

AIR PARTICULATE SAMPLE COLLECTION

AECOM's Radiological Service Technical Practice Group (RS-TPG) is responsible for the issuance, revision, and maintenance of this procedure. This procedure has also been provided to the United States Nuclear Regulatory Commission License Division of Nuclear Materials Safety (NRC LDNMS) as part of AECOM's "decommissioning license" application. Therefore, any deviations from the procedures set forth in this document require approval of the RS-TPG Leader and the NRC LDNMS license Radiation Safety Officer (RSO).

NRC DNMS License RSO Approval:  December 16, 2019

1 PURPOSE

The purpose of this procedure is to provide instructions for air particulate sample collection for radiation safety of workers and the public during performance of work at RS-TPG licensed projects or temporary job sites where AECOM personnel may be exposed to radioactive materials. The primary objectives of the air-monitoring program are to:

- Measure the concentration of the radioactive contaminant in the air through collection and analysis.
- Evaluate the performance of airborne radioactivity control measures.
- Assess air concentration data in order to determine if bioassay sampling should be initiated to verify whether an exposure has occurred and if so, the magnitude of the exposure.
- Determine if the level of protection offered to the employee is adequate

2 SCOPE

This procedure outlines the air particulate monitoring program for personnel working on AECOM project sites and the public where radioactive materials are present. This program also applies to projects where AECOM's NRC LDNMS radioactive materials license is used either in a state under reciprocity to the state's regulatory body or the US Nuclear Regulatory Commission (in non-agreement states). This document also outlines mandatory air monitoring requirements for accessing airborne radiological conditions for personnel and the public as required by 10 Code of Federal Regulation (CFR) 20, Appendix B, Table 1 "Occupational Values" and Table 2 "Effluent Concentrations". The RS-TPG Leader or the RS License RSO shall designate the individual(s) who are qualified to perform this monitoring. It is not meant to replace an instrument manual but, to supplement those procedures. It also augments other industrial hygiene air monitoring procedures intended to monitor for air contaminants that may be toxic but are not radioactive in nature.

3 DISCUSSION

Airborne radioactive contamination is of concern during any task that might result in contaminants becoming airborne. This is of particular concern because of the potential biological effects produced by internally deposited radionuclides. The inhalation of radioactive airborne particles is one of the most important routes of entry of radionuclides into the body. Air monitoring is performed as a means of detecting and quantifying airborne radioactivity in order to limit and prevent internal exposure and to keep necessary exposures As Low As Reasonably Achievable (ALARA) through engineering controls or protective equipment such as respirators.

Personal, Work Area and Environment Effluent air particulate samples will be collected during remediation tasks, specifically on workers when performing intrusive tasks. Samples are analyzed using gross alpha and beta counting techniques. If samples contain radioactivity in excess of 25% of occupational Derived Air Concentration (DAC) for the radionuclides of concern as presented in 10 CFR 20 Appendix B, engineering controls or a comprehensive respiratory protection program will be implemented. If necessary, personal air particulate and work area air particulate sampling results may be used to estimate internal deposition of radioactive material for the worker wearing the sampler, and for workers performing similar tasks in the work group in the same work area as described in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace".

The technique described in this procedure is very conservative, in that it attributes all long-lived alpha activity present on an air filter to the radionuclide(s) of interest at a site. It is likely some fraction of the long-lived activity on the filter will be attributable to background sources normally present in air. If reliable source term data is available, the dose may be portioned by percentage to other radionuclides.

If sufficient data to determine a worker's intake are available from both air sampling and bioassay measurements and the results are significantly different, the RS TPG licensee Site/RSO and/or CHP should base the worker's intake estimate on the data considered by the radiation protection staff to be the most accurate.

4 ALARA POLICY

It is AECOM's policy to plan and conduct its radiological activities safely and in such a fashion as to protect the health and safety of its employees, subcontractors, members of the public, and the environment. To achieve this, AECOM shall confirm efforts are taken to reduce radiological exposures and releases to the environment as low as is reasonably achievable (ALARA), taking into account social, technical, economic, practical and public policy considerations. AECOM's RS-TPG is committed to implementing this procedure and providing radiological air monitoring for AECOM personnel and the public in a manner to reflect this policy.

5 RESPONSIBILITIES

- Project Manager. Responsible for verifying site personnel are trained in the practice of radiological air monitoring and procuring the equipment necessary to perform radiological air monitoring at job site where radioactive contamination is present.
- Site/RS License RSO. Responsible for design and implementation the air monitoring programs and review of all data collected at RS License project sites. The RS License RSO verifies Health Physics Technicians implement the radiological air monitoring program as required in this procedure and other ancillary workers are qualified by training and experience to perform their assigned site tasks.
- Health Physics Technicians. Responsible for performing radiological protection surveys including performing worker breathing zone air monitoring, work area air monitoring, and environmental air monitor at the work site boundary to ensure that internal doses to the workers and public are maintained ALARA.
- Individuals. Each individual assigned to a project involving radioactive material shall wear and ensure air particulate monitoring devices are worn as instructed by the radiation protection staff and maintained during use with no adjustments to the pumps without direction of the radiological protection staff.

6 EQUIPMENT

The following are examples of instrumentation and equipment necessary to perform radiological air particulate monitoring at radiologically contaminated sites.

- Work Area and Environmental air monitoring obtain a calibrated air sampling pump with altitude correction chart capable of pulling air through an open face

47—mm—diameter glass fiber filter at a calibrated rate of 10 - 80 liters per minute (lpm). These pumps require AC power availability at the sampling locations. Example pumps are Eberline RAS-1 or F&J Model LV-1 (Low to intermediate volume samplers or equivalent).

- Worker breathing zone (BZ) air monitoring obtain a calibrated air sampling pump (Lapel pump) capable of pulling air through an open face 37 mm diameter glass fiber filter at a calibrated rate of 2 - 5 liters per minute (lpm). Example pumps are the MSA Escort ELF or Gilian Gil Air 5 Plus or equivalent. Battery powered capable of sampling for approximately 10 hours between charges.
- Calibration of Lapel Sampling pumps obtain a MinBUCK M-5 Primary Flow NIST traceable lapel calibration standard or equivalent.
- Calibration of Intermediate Volume Sampling pumps obtain a RADēCO Air Flow Calibrator primary flow venturi tube NIST traceable calibration standard or equivalent.
- Sample media for Work Area and Environmental Obtain 47mm (GFA Type A/E)
- Sample media and cassettes for Worker BZ Obtain 37mm (GFA Type A/E)
- Air sample disk portable alpha/beta counter, Ludlum Model 2929 attached to a zinc sulfide “phoswich” thin-window scintillator, Ludlum Model 43-10-1 or equivalent.
- Miscellaneous supplies. PPE (e.g. nitrile gloves), Tygon Tubing, 47 mm planchettes, tweezers, sample filter envelopes, field logbook, sample forms.

7 INSTRUMENT OPERATIONAL CHECKS

7.1 A pre-operational check will be performed on the Ludlum Model 2929/43-10-1 portable sample counter or equivalent instrument prior to use to verify the following requirements in accordance with RS-TPG SOP 001, *Portable Detection Equipment*. In general:

- The instrument must be source checked every day before use;
- The instrument has been calibrated within the last year;
- The battery check is satisfactory, and spare batteries are available (for portable instrumentation);
- Overall physical condition of the instrument is satisfactory; and
- A consistent low-background counting area must be selected for daily checks of the instruments.

8 PROCEDURES

The following procedures are for general guidance only. Project-specific work plans, work instructions and Radiation Protection Plan (RPP) will fully describe survey requirements.

8.1 General Work Area, Environmental, Background and Worker Breathing Zone Monitoring

8.1.1 General Work Area, Environmental Monitoring and Background Monitoring Sample Deployment

- 8.1.1.1** Load 47 mm diameter glass fiber filter into open faced filter holder of a calibrated sampling pump with rough irregular pattern facing outward. The sampler should be placed at a location that is representative of the air that the workers are breathing.

If performing an Environmental sample to assess public exposure, place the sampler downwind closest to the public. Two samplers are recommended to be placed 45 degrees apart from one another.

- 8.1.1.2** Each General Work Area and Environmental sample collected shall have a unique identification number assigned to it depending on sample purpose, type and location. The naming convention will be further discussed in individual site plans, procedures and work instructions. Example sample naming convention used may be as follows;

- Background Samples – Site Code-BKG#xx-mmddyyyy-xxx.
- Driller Breathing Zone – Site Code -DBZ#xx- mmddyyyy-xxx.
- General Work Zone – Site Code-GWZ#xx- mmddyyyy-xxx.
- Environmental Boundary – Site Code-ENV#xx- mmddyyyy-xxx.

- 8.1.1.3** With pump on for several seconds, record flow meter reading. Record on the Sample Field Sheet (Attachment 1) or Logbook the sample start time, the indicated flow, and the lapsed time meter reading (if available). Leave the sampler running to collect the sample on the filter.

- 8.1.1.4** Collect the sample for at least 2 hours depending on the radionuclide of concern. To measure the Thorium-232 DAC it requires a minimum of a 6-hour collection time at approximately 60 LPM to meet the MDC for measuring the regulatory DAC concentration. (Sample collection times will be specified in site specific plans and work instructions). Do not handle the filters with bare hands. Use of gloves is required as described in safety documentation.

Note: The actual flow for the 60 LPM rotometer indicated flow reading can be found on the sampler calibration record) Also an altitude and barometric pressure correction may need to be applied.

Record the time, the indicated flow meter reading, and elapsed time meter reading if available at the end of the sample collection. Remove the filter and store in a sealed container or envelope for analysis.

8.1.1.5 After waiting at least three hours (or 72 hours for radon/thoron progeny decay) from the end of sample collection, place the sample in the detector and make a count of at least 10 minutes and as long as 60 minutes depending on desired MDC. Record the start time and the result on the Air Particulate Sample Logging Form in Attachment 1 and complete the Radioactive Particulate Analysis Form in Attachment 2.

8.1.1.6 Use the following formula to calculate the alpha (α) and Beta (β) concentration:

$$C = \frac{(S - R_B) \times (FA)}{(2.22E + 6) (\epsilon_i) (V)}$$

where:

C = concentration in air uCi/ml

S = sample alpha count, rate (CPM)
= gross sample counts/sample counting time (min)

R_B = background count rate (CPM)
= background counts/background counting time (min)

ϵ_i = detector efficiency (cpm/dpm)

V = volume sampled (ml)
= average actual flowrate of air (lpm) x sample
collecting time (min) x 1000 ml/l

2.22E + 6 = Conversion factor, DPM to uCi

FA = Filter absorption factor
= .95 for glass fiber acetate (GFA) filter

DAC = derived air concentration (e.g. for total uranium
(Class Y); 2 x 10⁻¹¹ uCi/ml)

8.1.2 Personal air particulate sample monitoring deployment

- 8.8.2.1** Obtain a MSA or Gilian lapel air sampling pump or equivalent capable of pulling air through an open face 37 mm diameter glass fiber or cellulose membrane filter at a calibrated rate of 3 - 4 liters per minute (lpm) at the sampling location.
- 8.8.2.2** Ensure that lapel sampling pumps are fully charged prior to calibration and use. It is necessary to periodically run the pumps until the NiCd batteries are fully discharged. Discharging the batteries will eliminate the potential for memory buildup which can cause pumps to run short of their expected run time of 8-10 hours. Some charging systems are capable of performing this discharge function.
- 8.8.2.3** Turn the pump on and let it run for at least one minute
- 8.8.2.3** Calibrate the sampling pumps for the desired flow rate (3.5 lpm). Attach each pump to the soap film flow calibrator (MiniBUCK M-5 or equivalent), with an inline filter of the same type to be used for sampling. Initiate a bubble and through the sample volume. Perform 3 calibration run checks using the calibrator and if all 3 are within $\pm 20\%$ record the average in the field logbook or on Attachment 1.
- 8.8.2.4** Load 37 mm diameter glass fiber filter into a filter holder with rough irregular pattern facing outward and attach to a calibrated sampling pump. The sampling pump should be placed on the worker or on the equipment he/she is operating. The sampling holder should be placed at a location that is representative of the air that the worker is breathing. Clipping the filter cassette to the lapel of the workers coveralls or work attire usually works well. The sampler should always be placed on the worker in a location that does not hinder his/her safety or ability to perform their specific job task.
- 8.8.2.5** Start the pump and record flow rate, the sample start time, and the elapsed time meter reading (if available) and record on Attachment 1. Leave the sampler running to collect the sample on the filter.
- 8.8.2.6** Collect the sample for at least 4 hours. Record the time, elapsed time meter reading, indicated flow and total volume at the end of the sample collection. Remove the filter cassette and store the filter either in the cassette or in an appropriate container or envelope for analysis. Do not handle the filters with the bare

hands. Use of gloves is required as described in safety documentation.

- 8.8.2.7** Follow the same instructions for analyzing and recording the personal lapel sample results that are in Sections 8.8.1.5 and 8.8.1.6.

9 RECORDS

The person performing the sampling should record as much information as possible for the sampling performed. A description of the area sampled, and the process being sampled should be documented along with information on the sampling equipment used. These records should be reviewed by the License RSO. The results of the sampling will be compared to regulatory limits. Air Sampling records should include at a minimum;

- 9.1** Maintain a copy of air sampler calibration records.
- 9.2** Document daily source checks record in Attachment 1, RS-TPG SOP 001 in Field logbook or spreadsheet Attachment.
- 9.3** Maintain daily background measurements in Field Logbook or other daily survey record form (e.g. survey log form or daily source check record in Attachment 2, RS-TPG SOP 001.
- 9.4** Air Particulate Sample Logging Form in Attachment 1.
- 9.5** Air Particulate Sample Data Analysis Sheet in Attachment 2.
- 9.6** Access Control Sign-in/Sign-out Sheet record in Attachment 1, RS-TPG SOP 003.



The Site/RS License RSO shall maintain applicable air monitoring records on the project site and transfer them to the RS License file upon completion of site work.

ATTACHMENT 1
(RS-TPG SOP 019, R1)
AIR PARTICULATE SAMPLE LOGGING FORM (EXAMPLE)

Surveyor: <div style="text-align: center; font-size: 0.8em;">Print Name</div>		Date Drawn: 		
Air Sample Location: 		Air Sample Number: 		
Purpose/Type: 		RWP#: 		
Air Sampler Data: Manufacturer: Model #: Serial #: Calibration Date Due: 		Calibration Source Data: Manufacturer: Model #: Serial #: Calibration Date Due: 		
Flow Rate-MOB: Start LPM <div style="margin-left: 40px;"> Start Time: Stop Time: Start Time: Stop Time: Start Time: Stop Time: </div>		<div style="text-align: center;">Flow Rate - Check</div> <div style="margin-left: 40px;"> 1) 2) 3) Average ##### </div>		
Flow Rate-MOB: Stop LPM		(*) - Total counts (as found on instrument) (set dial to 1 and the count time select to x10)		
Ludlum Model 2929	Alpha Counts			Beta Counts
10 min Background				
60 min Background Count Date				

ATTACHMENT 2
(RS-TPG-SOP-019, R1)
AIR PARTICULATE SAMPLE DATA ANALYSIS SHEET (EXAMPLE)

Surveyor:				Date Drawn:			
	Print Name						
Air Sample Location:					Air Sample Number:		
Purpose/Type:					RWP#:		
Air Sampler Data:							
Model #:							
Serial #:			Start Time:				
Flow Rate:			Stop Time:				
Flow Rate:			Total Time:	#VALUE!	min		
Counter/Scaler Data:							
Model #:				Count Date:			Count Time:
Serial #:				Instrument Efficiency (ϵ_i):			(β γ)(cpm/dpm)
Probe Serial #:				Instrument Efficiency (ϵ_i):			(α)(cpm/dpm)
Cal Due:							
Background Count Time:			min (t_b)	Sample Volume (V):	#VALUE!	ml	
Gross Background (β γ):			counts	Sample Count Time:			min (t_s)
Gross Background (α):			counts	Gross (β γ):			counts
Gross Background (β γ):	#VALUE!		cpm (R_B) (β γ)	Gross (α):			counts
Gross Background (α):	#VALUE!		cpm (R_B) (α)	Gross (β γ)(S):	#VALUE!	cpm	
				Gross (α)(S):	#VALUE!	cpm	
MDC							
(β γ):	#VALUE!	dpm/100cm ²	#VALUE!	μ Ci/ml	Action Level	n/a	μ Ci/ml
(α):	#VALUE!	dpm/100cm ²	#VALUE!	μ Ci/ml	Action Level		μ Ci/ml
DAC (beta):	n/a	n/a	μ Ci/ml				
DAC (alpha):			μ Ci/ml				
Activity Concentration:							
(β γ):	#VALUE!	μ Ci/ml	Exceeds 25% DAC	n/a	Notify SRSO - Continue work		
			Exceeds 2x DAC	n/a	Stop work associated with the air sample - Notify LRSO		
(α):	#VALUE!	μ Ci/ml	Exceeds AL	#VALUE!	Notify RSO - Continue work		
			Exceeds 2x DAC	#VALUE!	Stop work associated with the air sample - Notify RSO		
Surveyor:							
	Signature			Date			
Reviewer:							
(LRSO/SRSO/CHP)	Signature			Date			

<div style="text-align: center;">  <p>Radiological Service Technical Practice Group Procedure</p> </div>	<p>RS-TPG-SOP NO. 026</p> <p>DATE: <u>May 4, 2020</u></p> <p>APPROVED:</p>
<div style="text-align: center;"> <p>ACCIDENTS AND EMERGENCIES PROCEDURE</p> </div>	<div style="text-align: center;">  <p>_____ Radiological Service Group Manager</p> </div>

ACCIDENTS AND EMERGENCIES PROCEDURE

1.0 PURPOSE

This procedure describes the Radiological Accidents and Emergencies Response Program used to direct personnel to perform immediate and supplementary actions to control the spread of contamination and minimize radiation exposure to workers, the public and environment during abnormal radiological situations.

2.0 SCOPE

This procedure applies to AECOM temporary jobsites where an AECOM radioactive materials license has been activated to support remediation and/or decommissioning activities. If a site-specific emergency plan has undergone the same or an equivalent review process, it may be used in lieu of, or as a supplement to, the requirements of this document. Supplemental information can be found in AECOM procedure S3AM-010-PR1, "Emergency Response Planning," and site-specific Radiological Protection Plans (RPPs).

Note: These Emergency Procedures are NOT applicable to Emergency Procedures relating to US DOT Shipping 49 CFR Part 172, Subchapter C – "Hazardous Materials Regulations" and 173, "General Requirement for Shipments and Packagings" site operations and 10 CFR Part 70, "Packaging and Transportation of Radioactive Material").

The following topics are included in Section 5.0 of this procedure:

- 5.1 General Requirements
- 5.2 Response to High Airborne Radioactivity
- 5.3 Response to Unanticipated Radiation Levels
- 5.4 Response to a Spill
- 5.5 Response to a Damaged or Leaking Source
- 5.6 Response to Unattended and Uncontrolled Radioactive Material

- 5.7 Response to Lost, Stolen, or Unaccounted for Radioactive Material
- 5.8 Response to a Fire Involving Radioactive Material
- 5.9 Response to Contaminated Personnel
- 5.10 Post-Radiological Incident Critiques

3.0 APPLICABLE GUIDANCE AND REGULATIONS

- 3.1 NUREG 1556, Vol. 18, Rev.1, "Consolidated Guidance About Materials Licenses", Section 8.10.1.
- 3.2 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations".
- 3.3 10 CFR Part 20, "Standards for Protection Against Radiation".
- 3.4 10 CFR Part 21, "Reporting Defects and Noncompliance".
- 3.5 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material".

4.0 RESPONSIBILITIES

- 4.1 The AECOM License Radiation Safety Officer (RSO) named on the radioactive material license enacted on a temporary job site is responsible for reviewing this procedure, and updating it as necessary, before the start of on the temporary job site.
- 4.2 During an incident requiring response by off-site emergency response personnel, the Site RSO (or Authorized User) and site health and safety officer (SHSO) are responsible for notifying the responding emergency organizations of the presence of radioactive materials and licensed activities at the temporary job site.
- 4.3 After all site personnel are safe, the Site RSO will notify the License RSO.
- 4.4 The License RSO will determine if the emergency condition is reportable to the licensing agency. If determine dot be reportable. The incident will be reported within 24 hours of the incident.
- 4.5 All project employees, contractors, visitors, client and regulatory personnel (employees, contractors, and visitors) must report any event they consider to be radiologically abnormal to the SRSO, SHSO and/or the responsible site manager. If the abnormal event is a life-threatening emergency anyone onsite should dial 911 immediately or other life threatening contact number identified on the posted emergency contacts list.

5.0 PROCEDURE

- 5.1 General Requirements.

- 5.1.1** Immediate actions may be performed in any order unless specified. Concurrent actions are preferred to expedite hazard mitigation and ensure exposures are as low as reasonably achievable (ALARA).
- 5.1.2** Emphasize supplementary actions after immediate actions have been performed.
- 5.1.3** Unless otherwise specified, response tasks may be performed by any radiological worker who is qualified to perform the action.
- 5.1.4** If there is a possible intake of radioactive material, inform Site RSO and License RSO so they may determine if internal dosimetry measures should be taken.
- 5.1.5** If SRSO or SHSO is not readily contacted, dial the general emergency phone number (i.e., 911) and notify the dispatcher of the nature of the radiological accident, potential releases, and potential or known personnel contamination.
- 5.1.6** Work shall not be resumed, nor shall the incident be secured, until:
 - a. The Site RSO and incident commander of the emergency responders has secured the scene and all instructions are completed and/or put into effect.
 - b. The Site RSO, License RSO, SHSO, the AECOM Regional Business Line Health and Safety Manager, and the responsible project manager have reviewed the incident together and are comfortable and confident of safe operations.
- 5.1.7** A formal critique, conducted in accordance with the "Post Radiological Incident Critiques," will be required by the Radiological Protection Plan (RPP) following an unusual radiological situation.

<p>Note: See Attachment 7.2 Regulatory Required Notifications for Emergency Reporting the Nuclear Regulatory Commission (Table 8.2, NUREG 1556, Vol 18, rev.1). Also, the state in which the emergency or incident occurred may have reporting requirements that may need to be adhered to.</p>
--

5.2 Response to High Airborne Radioactivity.

If continuous air monitors (CAM) or other real time air monitoring instrumentation are in use on the License project, this section addresses an alarm indicating a personnel threat.

- 5.2.1** Immediate Actions:
 - a. Stop work. Place work area in a safe configuration.

- b. Unprotected workers evacuate immediately.
- c. Read and note CAM output if available.
- d. Don respiratory protection if safety concerns require continued presence at the work site.
- e. Start, or ensure operation of, high efficiency particulate air (HEPA)-filtered ventilation if the work area is equipped with it.
- f. Ensure complete evacuation of the work area and account for all personnel.
- g. Contact the Site RSO, SHSO, or contact emergency response personnel (dial 911).
- h. All personnel remain isolated in an unaffected area until checked by the radiation protection technician for contamination.
- i. Isolate affected work area. This can be accomplished by closing doors and windows shutting down non-HEPA filtered ventilation, shutting process valves, etc.

5.2.2 Supplementary Actions

- a. The Site RSO or designee shall perform radiation surveys in adjacent areas and take required actions.
- b. The Site RSO or designee shall check affected personnel.
- c. The Site RSO or designee shall decontaminate contaminated personnel who in accordance with "Response to Contaminated Personnel," in Section 5.9 concurrently with other actions.
- d. The Site RSO or designee shall determine the personal protective equipment (PPE) required for entry and be responsible for airborne radiation sampling and surface contamination surveys of the affected and adjacent areas and ventilation systems.
- e. The Site RSO and SHSO, in conjunction with License RSO, project manager, and AECOM Regional Business Line Health and Safety Manager shall determine the cause of the incident.
- f. The Site RSO or designee shall post incident areas according to requirements in the RPP and radiological posting procedures.
- g. Project workers, under the supervision of the Site RSO and Site Manager, should decontaminate the areas as required to meet release and/or ALARA levels.

- h. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.3 Response to Unanticipated Radiation Levels.

Examples of unanticipated radiation levels include alarming remote area monitors (RAM), alarming supplemental dosimetry such as Electronic Personal Dosimeters (EPDs), or quickly increasing or off-scale readings on field radiation detectors. Other examples may include greater than normal routine radiation survey results. All such unanticipated radiation levels are all reportable to the Site RSO.

5.3.1 Immediate Actions.

- a. Inform others in affected work area.
- b. Stop work. Place work area in a safe configuration.
- c. Evacuate affected work area.
- d. Read and note RAM and supplemental dosimetry readings.
- e. Ensure complete evacuation of the work area and account for all personnel.
- f. Contact the Site RSO, SHSO, or contact emergency response personnel (dial 911).
- g. All personnel remain isolated in an unaffected area until checked by the radiation protection technician for contamination.

5.3.2 Supplementary Actions.

- a. The Site RSO or designee shall survey the affected and adjacent areas and post radiological areas as they are discovered.
- b. If airborne or personnel contamination is possible, all personnel and adjacent areas shall be surveyed for contamination.
- c. The License RSO, in consultation with the Site RSO, and the SHSO shall determine appropriate PPE.
- d. The Site RSO and SHSO, in conjunction with License RSO, project manager, and AECOM Regional Business Line Health and Safety Manager shall determine the cause of the incident.
- e. After the cause has been determined, mitigate the hazard by using time, distance, shielding. This shall be done by the Site RSO and the project manager through new or revised to Radiation Work Permits (RWPs).

- f. The Site RSO or designee personnel shall survey the affected area and ensure that posting complies with the RPP, RWP and regulatory requirements.
- g. The Site RSO will collect personnel dosimeters from all affected personnel and order a priority analysis. Personnel must be issued another dosimeter prior to re-entry into radiological areas.

5.4 Response to a spill.

<p>Note: Specialized actions for a dry, powdery spills are marked with an asterisk (*). Actions required for responding to a CAM alarm are also generally applicable for a dry spill.</p>
--

5.4.1 For spills involving highly toxic chemicals, workers shall:

- a. Immediately exit the area without attempting to stop or secure the spill.
- b. Call 911.
- c. Contact the SHSO or other project site safety personnel and site manager.

5.4.2 Immediate Actions.

- a. Stop or secure the operation causing the spill. For a dry spill that is not water-reactive, cover the spill area with a damp cloth or absorbent.
- b. Warn others. Contact the Site RSO and License RSO after the emergency response organization is contacted through dialing 911. Notify the responsible task leader.
- c. Isolate the area. Potentially contaminated personnel shall evacuate the spill area to a "holding area" until monitored by the SRSO or designee.
- d. Minimize personal exposure to radiation and contamination.
- e. Secure or redirect ventilation that is not high efficiency particulate air (HEPA)-filtered if the spill occurs inside.

5.4.3 Supplementary Actions.

- a. The Site RSO or designee shall verify that there is no contamination outside the boundaries of the controlled area and survey for airborne contamination in affected and adjacent areas. National Emission Standards for Hazardous Air Pollutants (NESHAPS) monitoring samples should be collected and analyzed as soon as possible.
- b. The members of the Licensed Project team shall work under direction of the Site RSO to clean up the spill after appropriate training in cleanup

methods, PPE usage, and modifications to project Work Plans, the Site Safety and Health Plan, Radiation Protection Plan, and the RWP.

- c. For a dry spill, clean up contamination with a dedicated HEPA-filtered vacuum cleaner and monitor airborne radioactivity levels as directed by the Site RSO, SHSO and/or License RSO.
- d. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.5 Response to a Damaged or Leaking Source.

Warning: Do not handle known or potentially leaking sources until radiation and contamination surveys are performed and direction is received from the Site RSO.

5.5.1 Immediate Actions.

- a. Take immediate actions to the leaking source to prevent the potential spread of contamination.
- b. Inform the Site RSO or designated source custodian and then contact the License RSO.
- c. The Site RSO or designee shall remove the leaking source from service. Handle the source with tongs or tapers and nitrile gloves and place the source in a sealable plastic or glass container.
- d. The Site RSO or designated radiological staff shall tag the source container as containing contaminated radioactive material.
- e. The License RSO, Site RSO shall arrange for disposal of the leaking source.

5.5.2 Supplementary Actions.

- a. The Site RSO or designated radiological staff shall survey source users, storage areas, use areas, instrumentation in use areas, adjacent areas, and nearby "eating, drinking, or smoking" areas for contamination.
- b. In the event of any personnel contamination, the Site RSO shall ensure that decontamination procedures are started.
- c. The Site RSO shall inform the License RSO, the AECOM Corporate Radiation Safety Officer, and the AECOM Regional Business Line Health and Safety Manager and update source records in compliance with company radioactive source control procedures.
- d. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.6 Response to Unattended and Uncontrolled Radioactive Material on a Client's Jobsite.

5.6.1 Immediate Actions.

- a. Assume temporary custody of and control access to the licensed radioactive material.
- b. Minimize exposure by a distance still allows control of the radioactive material.
- c. Instruct another project team member to notify the Site RSO, while maintaining control of the radioactive material.
- d. The Site RSO or designated radiological personnel shall survey, identify, and control the radioactive material and affected areas.
- e. The Site RSO shall notify the client representative and the License RSO and determine if AECOM is to continue control of the radioactive material under one of its Radioactive Materials Licenses. If AECOM is to control the material, the License RSO will verify that the activity of the source will not exceed the AECOM license limits and then make the appropriate licensing agency (US Nuclear Regulatory Commission [NRC] or State licensing agency).
- f. If AECOM is not capable or contractually obligated to take control of unlicensed radioactive material at a client's jobsite, the License RSO will work with the client to make the proper notifications to Federal and State authorities.

5.6.2 Supplementary Action.

- a. If control of the radioactive materials is delegated to a non-AECOM party, the party shall demonstrate proper radiological controls to the satisfaction of the Site RSO and License RSO. Discuss this issue in the radiation safety and RWP briefing meetings.
- b. Investigate the root cause of the incident and document all corrective actions in the Site RSO Logbook and recommended disciplinary actions to project personnel if deemed necessary in a memorandum to the License RSO and the employees personnel file.
- c. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.7 Response to Lost, Stolen, or Unaccounted for Radioactive Material.

- ### **5.7.1** Contact the Site RSO and the License RSO. If source was lost or stolen contact the local authorities to start a legal investigation. If the activity of the radioactive material can cause a potential acute exposure to the public, dial 911. The lost, stolen, or unaccounted source shall be reported immediately

to the NRC or State licensing agency with a written report on the incident within 30 days.

- 5.7.2** The Site RSO, License RSO, and AECOM Regional Business Line Health and Safety Manager shall investigate.
- 5.7.3** If practical, the Site RSO or designee shall perform radiation surveys in attempt to locate the source.
- 5.7.4** The Site RSO and the Project Manager shall commit as many personnel as practical to perform visual searches.
- 5.7.5** The Project Manager shall provide a facility/site-wide announcement of the lost, stolen, or unaccounted for radioactive material.
- 5.7.6** The Site RSO shall increase access controls to comply with the radioactive material license and license project procedures.
- 5.7.7** The Site RSO shall inform, give direction to, and answer questions of the security/police inspectors about the missing radioactive material.
- 5.7.8** A report shall be generated to document the incident in accordance with AECOM incident reporting procedures. This report shall be distributed to the License RSO for inclusion to the Radioactive Material License (if applicable) and sent to the NRC and State licensing agency authorities within 30 days.

5.8 Response to a Fire Involving Radioactive Material.

5.8.1 Immediate Actions.

- a. Take actions as required with any fire (i.e., pull fire alarm, warn others, and call 911). Include the presence and magnitude of radiation, if known, in the report to the 911 dispatcher.
- b. Use portable fire extinguishers if safe to do so. Never attempt to fight a structural fire. The fire extinguisher should only be used for escape.
- c. Evacuate up-wind and account for personnel.
- d. Assist and advise the responding fire department, security or police through the incident commander.
- e. Call the Site RSO and SHSO and alert the local project team of the situation.
- f. The Site RSO and radiological safety staff and project personnel shall ensure the radiological safety of the firefighters and ensure techniques used to fight the fire do not needlessly spread radioactivity.

- g. The radiological safety staff or designee shall invoke radiological controls under the direction of the Site RSO, ensuring that fire-fighting is not impaired.

5.8.2 Supplementary Actions.

- a. As soon as safety and practicality allow notify, the License RSO can notify the NRC and State licensing agency if the release was is greater than 5 times the limit of the lowest annual limit of intake for the material involved of the fire and/or explosion within 24 hours. A written report by the License RSO will be submitted to the NRC within 30 days.
- b. Fire fighters and affected personnel shall stay segregated from others until monitored by the Site RSO or designee.
- c. Respond as appropriate to other associated problems such as spill, high airborne radioactivity, or contaminated personnel.
- d. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.9 Response to Contaminated Personnel.

5.9.1 Immediate Actions.

Warning: In the event of an injury and radioactive contamination or personnel, the medical well-being of the person shall always have priority over the contamination. Radiological control measures are allowed only if they do not in any way hamper the medical aid to the victim or the life of the victim.

- a. Stop work and place work area in a safe work configuration.
- b. Identify, segregate, and minimize the movement of the contaminated person.
- c. Minimize the spread of contamination.
- d. Call (or preferably, ask someone to call) for assistance. Contact the Site RSO or the radiation safety staff.
- e. If the contaminated person is injured:
 - If there is a serious or life-threatening injury, call 911 immediately. Provide specific information on the victim's condition to the emergency responders and send someone to a location to meet the responders in order to expedite the ability to perform care. Otherwise, administer first aid.
 - Cover wounds with clean material to prevent further contamination.

- Brief medical personnel upon their arrival.
 - The Site RSO or designee shall survey and provide radiological controls in a manner that will not impede the medical care of the victim.
 - Medical personnel should transport the contaminated injured person to medical facilities accompanied by the Site RSO or designee with the appropriate contamination survey instrumentation in case it is need at the medical facility.
 - Once and as soon as practical, notify the License RSO so that he/she can make the proper notifications to the regulatory authorities.
 - Proceed to step 5.9.1.n.
- f. If there are no injuries, then the radiation safety staff, Site RSO or designee shall perform a whole-body survey of the contaminated individual(s). If major portions of the body are contaminated, or if contamination is detected on the face or in the eye area or eyes, ears, nose or mouth, Site RSO shall inform the AECOM Regional Business Line Health and Safety Manager and implement internal dosimetry procedures as soon as possible. The License RSO shall be notified as soon as practicable and he/she shall notify the NRC or State licensing agency within 24 hrs.
 - g. If there is suspected internal contamination, the Site RSO or designee shall take nasal smears, throat swabs, and/or sputum samples. These samples should be taken and analyzed as soon as possible. Samples should be taken prior to attempts to expel contamination through actions such as nose blowing.
 - h. If personnel contamination is detected, Site RSO, radiation safety staff or designee shall survey the site of the contamination incident and delineate and post a "Contamination Area" if necessary.
 - i. Remove any contaminated PPE and personal clothing, and survey skin surfaces underneath. Whenever possible, take appropriate measures to protect the privacy of the affected individual.
 - j. For major personal contaminations, proceed to step 5.9.1.m. If no injuries are involved and the contamination is confined to a small area of the body or clothing, the Site RSO or designee may perform basic, non-abrasive decontamination at the site.
 - k. The Site RSO or designee shall resurvey for contamination after the initial decontamination effort. Repeat decontamination and surveys as necessary. If three attempts of decontamination are made without significant reduction in contamination levels, then an alternate method of decontamination shall be employed. If the affected area becomes irritated, stop and call 911. Proceed to supplementary actions.

- l. If large portions of the body are contaminated, the Site RSO or designee shall call 911 and work with the responding personnel to transport the contaminated individual to a local decontamination facility or hospital equipped to handle contamination cases.
- m. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.9.2 Supplementary Actions.

- a. Dress the individual in clean clothes such as work coveralls or Tyvek if no more contamination is detected.
- b. At the conclusion of the response, treatment, and decontamination activities, the Site RSO or designee shall perform contamination surveys of all individuals who were directly involved, as well as vehicles, stretchers, blankets, affected equipment, and affected areas.
- c. The Site RSO, radiation safety staff designee shall direct and participate in the required area and material decontamination.
- d. If the individual's clothing is contaminated and the contamination cannot be removed by tape press methods, the radiation safety staff and the Site RSO may hold the clothing for cleaning or disposal.
- e. The Site RSO or radiation safety staff shall transmit a complete account of the contamination incident with to the License RSO within 2-hours of the incident and assessment.
- f. The contamination individual(s) shall meet with the Site RSO, the License RSO, the Project Manager, and Regional Business Line Health and Safety Manager to ensure that any health concerns are addressed, and that documentation is complete. This meeting can be performed through a teleconference call and all results and discussions will be kept confidential. When the conditions under which the emergency or accidental exposures were received have been eliminated, the License RSO shall notify the NRC or State licensing agency within 24 hrs and submit a written report within 30 days of the event.
- g. The SHSO or Project Manager shall make notifications in accordance with AECOM's incident reporting procedures.

5.10 Post-Radiological Incident Reports.

- 5.10.1** Reports are required after a radiological emergency response to document a chronological listing of events as required in Attachment 7.2.
- 5.10.2** Reports shall be conducted as soon as practicable after the emergency is stabilized and in accordance with Attachment 7.2. The Site RSO, License RSO, Project Manager, and SHSO will provide the critique leader with all project information necessary to complete the incident critique report.

5.10.3 The Report shall be an aid to the successful completion of these and allow a rapid gathering of data to establish the whole truth regarding the emergency response that can be used for reporting to the NRC or State licensing agency.

5.10.4 At a minimum, the report process shall include:

- a. Notifications in accordance with AECOM's incident reporting procedures by the SHSO or Project Manager.
- b. Minutes from a formal meeting chaired by the License RSO and attended by the Site RSO, SHSO, AECOM Regional Business Line Health and Safety Manager, and the individual(s) involved in the incident.
- c. Personal statement forms completed by selected personnel before the meeting and attached to the minutes at the end of the meeting.
- d. Recorded minutes signed by the report leader.
- e. A listing of the events in chronological order.
- f. A somewhat subjective list of what went right, what went wrong, and lessons learned.
- g. Supporting materials, including documents, survey forms, survey data, meteorological data, photographs, and records.
- h. Corrective Actions implemented to prevent recurrence.

5.10.5 The meeting should occur as soon as practicable after the event, and last only long enough to get the facts in order to meet the 30 written regulatory reporting requirements published in Table 8-2 of NUREG 1556, Vol. 18.

6.0 RECORDS

- 6.1** Incident Report meeting minutes shall be submitted to and maintained by the License RSO in the applicable license file.
- 6.2** Site RSO Logbook and applicable radiological survey forms and data produced post-incident. This can also include witness accounts, theft records from law enforcement and interviews from site personnel involved and not involved with the incident.
- 6.3** Incident Reports and correspondence to the NRC or State licensing agency.
- 6.4** The License RSO is responsible for maintaining all radiological records including those pertaining to license sources, documentation and objective evidence to support the license requirements implementation and effectiveness.

- 6.5** A copy of all incident and emergency response operations documentation should be maintained in applicable license files and a copy forwarded to the AECOM Regional Business Line Health and Safety Manager.

7.0 ATTACHMENTS

- 7-1 Emergency Contacts List (Example)
- 7-2 Regulatory Required Notifications

Attachment 7-1

Emergency Contacts List (Example)

Project Name:		Project Number:	
Approval Date:		Prepared by:	
<p><u>Report ALL SH&E Incidents, no matter how minor, to the AECOM Incident Hotline: 800-348-5046.</u></p> <p>This reporting includes, but is not limited to any vehicle incident, any injury or illness potentially related to a project including minor injuries that may or may not require first aid, property damage, fires, theft, regulatory inspections, environmental releases.</p>			
<p>Identify the nearest Occupational Clinic and Hospital to the site that accepts AECOM Workers' Compensation Insurance (see Attachment A for instructions). If the nearest such clinic or hospital is an unreasonable distance from the site, identify nearer hospitals or clinics. Attach maps and directions to the clinics and hospitals in Attachment A.</p>			
Nearest Occupational Clinic:		Phone Number: Hospital Urgent Care Clinic	
Address:			
Nearest Hospital with Level 1 Emergency Room		Phone Number:	
Address:			
Key Personnel			
Project Manager (PM):		Cell Phone:	
Site Manger (SM):		Cell Phone:	
Site Health & Safety Officer (SHSO)		Cell Phone:	
Site Radiation Safety Officer (SRSO):		Cell Phone:	
License Radiation Safety Officer (LRSO):		Cell Phone:	

AECOM Regional H&S Manger		Cell Phone:	
Client:		Phone:	
Client: (RSO)(POC)		Cell Phone:	
State Agency Emergency Operations Center (EOC)		Phone:	
US Nuclear Regulatory Agency			
US NRC Operations Center – 24 Hours	Bethesda, MD	Phone:	(301) 816-5100 (main) (301) 951-0550 (fax)
US NRC – Region I	King of Prussia, PA	Phone:	(800) 432-1156
US NRC – Region II	Atlanta, GA	Phone:	(800) 577-8510
US NRC – Region III	Lisle, IL	Phone:	(800) 522-3025
US NRC – Region IV	Arlington, TX	Phone:	(800) 952-9677
US NRC – Safety (Hotline)		Phone:	(800) 695-7403
Office of Inspector General (Hotline)		Phone:	(800) 233-3497





Attachment 7-2

Regulatory Requirements Notifications (NUREG 1556, Table 8.2)

Typical NRC Notifications Required for Service Providers			
Event	Telephone Notification	Written Report	Regulatory Requirement
Package received with removable radioactive surface contamination exceeding the limits of 10 CFR 71.87(i) or external radiation levels exceeding the limits of 10 CFR 71.47	Immediate (NRC and final delivery carrier must be notified)	None	10 CFR 20.1906(d)
Theft or loss of material	Immediate	Within 30 days	10 CFR 20.2201(a)(1)(i) & (b)(1)
Whole body dose greater than 0.25 Sv [25 rem] per event	Immediate	Within 30 days	10 CFR 20.2202(a)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 2.5 Gy [250 rad]	Immediate	Within 30 days	10 CFR 20.2202(a)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rem] in 24 hours	Within 24 hours	Within 30 days	10 CFR 20.2202(b)(1)(i) 10 CFR 20.2203(a)(1)
Extremity dose greater than 0.5 Sv [50 rem] in 24 hours	Within 24 hours	Within 30 days	10 CFR 20.2202(b)(1)(iii) 10 CFR 20.2203(a)(1)
Whole body dose greater than 0.05 Sv [5 rem] in a year	None	Within 30 days	10 CFR 20.2203(a)(2)(i)
Dose to individual member of public greater than 1 mSv [100 rems] in a year	None	Within 30 days	10 CFR 20.2203(a)(2)(iv)
Defect in equipment that could create a substantial safety hazard	Within 2 days	Within 30 days	10 CFR 21.21(d)(3)(i) & (ii)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	Immediate	Within 30 days	10 CFR 30.50(a)&(c)(2)
Unplanned contamination event that requires restricted access for more than 24 hours and involves a quantity of material greater than five times the lowest annual limit on intake for the material as specified in Appendix B of 10 CFR Part 20 and requires the area to be restricted for a reason other than to allow radionuclides with half-lives less than 24 hours to decay	24 hours	30 days	10 CFR 30.50(b)(1) & (c)(2); 40.60(b)(1) & (c)(2); and 70.50(b)(1) & (c)(2)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	Within 24 hours	Within 30 days	10 CFR 30.50(b)(2) & (c)(2)

Typical NRC Notifications Required for Service Providers			
Event	Telephone Notification	Written Report	Regulatory Requirement
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	Within 24 hours	Within 30 days	10 CFR 30.50(b)(4) & (c)(2)
Determination that any licensee that has not previously implemented the Security Orders (i.e., orders issued by the NRC to require licensees to implement interim security measures) or been subject to the provisions of 10 CFR Part 37, Subpart C will aggregate radioactive material to a quantity that equals or exceeds the Category 2 threshold	None	90 days before aggregating radioactive material to a quantity that equals or exceeds the Category 2 threshold	10 CFR 37.41(a)(3)

 <p>Radiological Service Technical Practice Group Work Instruction</p>	<p>INSTRUCTION NO. <u>001</u></p> <p>DATE: <u>September 27, 2017</u></p> <p>APPROVED:</p> <p></p> <p>_____ Radiological Service TPG Leader</p>
<p>Delineation Drilling and Gamma Logging</p>	

Work Instruction

DELINEATION DRILLING AND GAMMA LOGGING

AECOM's Radiological Service Technical Practice Group (RS-TPG) is responsible for the issuance, revision, and maintenance of this policy. This instruction is to be used on AECOM field projects where Radioactive Materials license work is being performed by the AECOM Radiological Technical Services staff. Any deviations from this instruction set forth in this document require approval of the RS-TPG Leader and AECOM Project Radiation Safety Officer (RSO).

Project Health Physicist Approval: _____ September 27, 2017

1.0 PURPOSE

The purpose of this instruction is to provide instruction for performing delineation drilling and gamma logging for characterization of sub-surface radioactive contamination. This instruction also describes responsibilities of personnel and contractors performing the characterization activities. The primary use will be to quantify the horizontal and vertical extent of gamma emitting radiological contaminants with concentrations exceeding the measurable local area background subsurface radiation. AECOM's standard operating instruction for down-hole gamma logging has been revised to be applicable to the delineation of radioactive material. SCOPE

This work instruction provides guidance for use of portable radiation survey instrumentation to characterize a source of subsurface radiological contamination on licensed and temporary AECOM work sites. The RS-TPG leadership, the Project Health Physicist (HP) or Site Radiological Safety Officer (SRSO) whose roles are defined in the site Radioactive Material Investigation Work Plan (Work Plan) will coordinate the gamma logging, sampling, and data collection efforts. The study area is shown in Figures 3 and 4 of the Work Plan and also included in Attachment A. For aspects of specific radiological instrumentation operation, calibration, response check and specifications not covered in this instruction, refer to the instrument manufacturer's technical operations manual in Attachment B, RPP-AMS-094, (Operation of NaI Detectors) and Procedure AECOM RS-TPG-SOP-001 (Portable Detection Equipment, starting with Section 5.2 found in Attachment B).

2.0 ALARA POLICY

It is AECOM's policy to plan and conduct its radiological activities safely and in such a fashion as to protect the health and safety of its employees, subcontractors, members of the public, and the environment. To achieve this, AECOM shall confirm that efforts are taken to reduce radiological exposures and releases to the environment as low as is reasonably achievable (ALARA), taking into account social, technical, economic, practical and public policy considerations. AECOM's



RS-TPG and Project RSO are committed to implementing this instruction and maintain radiation detection equipment in a manner to reflect this policy.

4.0 DEFINITIONS

4.1 Gamma Logging

Method for characterizing the vertical extent of radiological contamination at concentrations greater than what is present in the local area subsurface test hole background. The gamma NaI probe of varying diameters is lowered into the characterization test hole and measurements are recorded in six-inch increments to a depth where the contaminant is no longer detected.

4.2 Delineation drilling

Delineation drilling is a method where a subsurface background radiological area vertical and horizontal boundary can be identified from a radiological contaminated vertical and horizontal area.

5.0 EQUIPMENT

5.1 Portable Radiological Survey Instruments

- 5.1.1 Ludlum Model 2221 or 2226 Scaler/ratemeter with RS232 or data logging capability or equivalent.
- 5.1.2 Ludlum Model NaI (TI) gamma scintillations detector
 - 5.1.2.1 Ludlum Model 44-10 (OD = 2.6 in.)(min. Geoprobe ID = 2.75 in.)
 - 5.1.2.2 Ludlum Model 44-2 (OD = 2 in.)(min. Geoprobe ID = 2.6 in.)
 - 5.1.2.3 Ludlum Model 44-62 (OD = 0.9 in.)(min. Geoprobe ID = 1.5 in.)

5.2 Global Positioning System (GPS) & Field Data Logger (optional)

- 5.2.1 Trimble Pro XRT, XRS, or XH GPS Survey System used to locate and document the test hole locations.
- 5.2.2 Archer Data Logger with RS232 cabling.
- 5.2.3 Field Laptop computer with Trimble GPS Pathfinder Office and TeraSync Software.
- 5.2.4 Licensed Surveyor in lieu of GPS depending on project QA requirements

5.3 Drilling Equipment

Mechanical equipment such as a Geoprobe Drill Rig capable of pushing pipe between 3.5 in. OD/2.75 ID at a minimum of 12.5 lbs/ft in order to accommodate all potential detector sizes as found in section 5.1.2 or manual equipment to advance each test whole to the desired depth.



6.0 REQUIREMENTS

6.1 Safety

The current provisions of the Site HASP, Radiological Protection Plan (RPP), Community Air Monitoring Plan (CAMP) and Work Plan shall be followed for all aspects safety for performing work under this instruction.

6.2 Training & Qualifications

The Project RSO with License RSO and Site RSO (SRSO) concurrence shall ensure that all Health Physics (HP) staff or other approved technicians who will be performing the health physics duties in accordance with this instruction have been trained and understand their role and responsibilities.

6.3 Quality Assurance

HP staff or other technicians approved by the project Radiation Safety Management shall ensure that all portable survey equipment used in accordance with this plan is properly functioning, has valid calibration and has been daily reference function checked and background checked in accordance with AECOM RS-TPG-SOP-001 (Attachment B). The observed counts per minute value corresponding to background for the Ludlum Model 2221 Ratemeter/scaler must be documented in the appropriate space on the Borehole Field Log form in Attachment C.

7.0 DELINEATION DRILLING METHODS

7.1 Responsibility

The Site Manager or designee is responsible for implementing this activity. The Site Manager will appoint a RIL to supervise field activities, maintain records and otherwise conduct QC duties as described in this instruction.

7.2 Surface Gamma Survey

A surface gamma survey in open land areas with the potential for contamination will be performed prior to any intrusive activity to identify any count rates distinguishable above the local background. The survey data may be recorded by hand on a project survey sheet or with the Archer datalogger or Trimble datalogger in tandem with a GPS survey system capable recording position and gamma count rate data in 2 second intervals. If area is paved a 1 minute gamma count will be performed at the interface between the pavement and the material below.

If isolated points of elevated activity are located during the surface gamma survey and were performed at a different time these points shall be rechecked prior to drilling. Rechecking



shall be done by performing additional surface gamma surveys in those areas to confirm the initial readings.

7.3 Drilling and Gamma Logging Instructions

- 7.3.1 Utilities will be located prior to performing any ground intrusive activity on a property. The Site Manager or designee will be responsible for originating a request through the local utility locator service for each area where drilling is proposed. The phone number for a utility locate request for this project can be done by dialing 811. This request must be performed at least 72 hours prior to the intrusive activity. In addition, representatives of major electric utilities may need to be present when intrusive activities are performed inside any power utility corridors or right-of-way on site.
- 7.3.2 Each test hole will be located by means of GPS, licensed surveyor or the use of a measuring tape and a compass. A hollow 2"-diameter O.D. drill pipe or other size depending on the desired detector will be advanced into the ground by mechanical or manual means to a minimum depth of 36 inches (3 feet) below grade surface, with a preferred depth of 72 inches (6 feet) below ground surface (bgs), or until refusal. This depth may be extended, if required, as discussed in Section 7.3.7. procedures regarding refusal and as discussed in Section 7.3.9.
- 7.3.3 A HP or other technician will lower the model 44-2 or 44-62 probe into the geoprobe test hole to a depth three-inches below grade surface (bgs). At that depth, the gamma rate will be recorded following a one-minute counting time. The model 44-62 probe will then be lowered to the bottom of the hole in six-inch increments and the gamma rate will be recorded following a one-minute counting time at each six-inch increment. Data will be recorded either on the "Borehole Field Log Sheet" provided as Attachment C, or directly input into the optional field PDA data logging computer. In order to avoid the test holes from sluffing or caving in the hole will be lined with the appropriate size of thin wall PVC. For the 44-62 detector that size would be a minimum of 1.25 in. ID and for the 44-2 the size would be a minimum of 2.00 in. ID
- 7.3.4 Test holes will be located along sections perpendicular or approximately perpendicular to the direction of the utility corridor transect. Sections will be taken at approximately three-meter intervals along the entire transect length to the end of the survey area. If subsurface gamma survey readings exceed the criteria based upon the background test holes additional test locations will be further investigated using drilling and gamma logging. If additional information is required to quantify the horizontal and vertical extents of material exceeding the background screening action level the Project HP and SRSO will be consulted for collecting additional samples for laboratory analysis.



Sections will be started by advancing a test hole as near to utility corridor as possible, and advancing additional test holes away from the utility corridor until contamination is no longer encountered. Additional test holes will only be advanced into the utility corridors when only under the direct supervision of the responsible utility company representative to fully characterize the lateral and vertical extent.

- 7.3.5 Additional test holes at three-meter step outs will be advanced and gamma logged until the initial surface gamma survey outline or potentially affected area boundary is reached which can be seen in Figure 4 of the Work Plan and Attachment A.
- 7.3.6 If down-hole gamma logging results at the edge of the suspected impacted area indicate contamination greater than the background action level additional test holes will be stepped-out in subsequent three-meter increments until results indicate concentrations are less than the criteria for the full vertical extent of 6 feet for the test hole. A step back of 1.5-meters will then be conducted to further define the lateral extent of contamination.
- 7.3.7 During test hole gamma logging, if the bottom two gamma measurements indicate the presence of material at concentrations exceeding the background action level the test hole will be further advanced to achieve two or more successive six-inch increment readings below the criteria or until refusal. The field logs and/or electronic data files will include an explanation of the refusal or other pertinent comments if any readings in the bottom 12 inches exceeds the background criteria.
- 7.3.8 The Project HP or his designee is responsible for reviewing the gamma logs for completeness and data inconsistencies in a timely manner. The Project HP or his designee is responsible for collecting the gamma logs from the HP staff or technician performing the field measurements.
- 7.3.9 Physical obstructions (i.e. utilities, buildings, rocks, trees or topography) may prevent test holes from being located at the necessary measured location or from being extended to the minimum required depth of 72-inches. If this occurs, an alternate location should be used that is as close to the preferred location as reasonable and practical. The reason for use of an alternate location should be documented on the field borehole log and the location should be surveyed in accordance with the requirement in section 7.3.2.

7.4 Soil Sampling

- 7.4.1 Soil sampling is discussed in detail in the Work Plan. Soil samples will be collected at the direction of the Project HP or SRSO and submitted to an offsite laboratory for radiological analyses. The soil samples will be collected from the test hole boring cores based upon scans performed with a NaI detector and a shielded GM-pancake (Ludlum 44-40). Elevated readings on a core will be sampled at the



discretion of the Project HP or SRSO. At a minimum each clean test hole bottom will be sampled.

7.4.1 The soil samples will be identified through the following naming description.

RA Area–Sample Type –Hole Number – Collection Interval Depth–Date–Sample Type

Areas

RA01 – Remediation Area 01

BKG– Background Area

Sample Types

BG – Biased Grab

COM – Composite

WST – Waste

CBB – Clean Borehole Bottom

Proposed Initial Sample and Survey Intervals (bgs)(6 ft. deep test hole)

1 – (0–6) inches

2 – (6–12) inches

3 – (12–18) inches

4 – (18–24) inches

5 – (24–30) inches

6 – (30–36) inches

7 – (36–42) inches

8 – (42–48) inches

9 – (48–54) inches

10 – (54–60) inches

11 – (60–66) inches

12 – (66–72) inches

13 – (72–78) inches

Example Sample # RA01-BH-1-13-072117-BHB

This a Borehole Bottom biased grab sample collected from test borehole #1 in R01 from 72-78 inches on July 21, 2017.

7.4.2 The Project HP or designee (SRSO) is responsible for completing the sample chain of custody (COC) forms found in Attachment D. The Project HP will review all laboratory results for completeness and data inconsistencies in a timely manner and report the results to the Site Manager, who in turn will report the results to the NYSDEC.

7.5 Physical Survey and Mapping

The physical location and elevation of every test hole will be recorded using either GPS or traditional land surveying techniques. Original field data will be kept in the project files under standard AECOM Document Control procedures. Locations will be based on State



Plane coordinates in Northing and Easting and elevations will be recorded mean sea level. Horizontal locations will be recorded to the nearest foot. Ground surface elevations will be recorded to the nearest tenth of a foot.

The location of completed test holes will be shown on field maps prepared by the Project HP. The Project HP and Site Manager are responsible for comparing the map of completed field test holes to the surface gamma survey and gamma log data to ensure that the test holes cover the potentially impacted area in accordance with the Work Plan.

8.0 RECORDS/REPORTS/NOTIFICATIONS

The following documents will be maintained as quality records:

- Field Logbooks
- Test hole gamma logging sheets
- Soil sample results
- Physical survey notes
- Electronic Data
- Map of test hole locations
- Radiological Instrumentation Documentation/Response Check/Calibration Records
- Radiation Survey/Contamination Survey Data

9.0 ATTACHMENTS

9.1	Attachment A	Radiological Work Plan Figures 3 and 4
9.2	Attachment B	Instrumentation Use Guide
9.3	Attachment C	Example Borehole Field Log Sheet
9.4	Attachment D	Example Chain of Custody



Attachment A

Radiological Work Plan Figures 3 and 4

Attachment B

Instrumentation Use Guide

5.2 Background Measurement for Scaler Instruments (Initial Setup)

- 5.2.1 Verify that the background area is free of radioactive sources. The detector geometry should be set up in the same configuration as that to be used when counting samples to produce the most accurate results.
- 5.2.2 Perform the background measurement for one minute and record the total counts measured (C_b) on the Scaler Instrumentation Background Setup Sheet, Attachment 2.
- 5.2.3 Repeat the background measurement 9 times, for a total of ten measurements. Record the total counts observed (C_b) for each measurement on the Scaler Instrumentation Background Setup Sheet, Attachment 2.
- 5.2.4 Calculate the average background counts (\overline{C}_b), the standard deviation (SD_b) and average background count rate (\dot{C}):

$$\overline{C}_b = \frac{\sum_i^n C_i}{N}$$

$$SD_b = \sqrt{\frac{\sum_i^n (C_i - \overline{C}_b)^2}{N - 1}}$$

$$\dot{C}_b = \frac{\overline{C}_b}{t_b}$$

where:

\overline{C}_b = average background count

SD_b = standard deviation of the average background

N = number of measurements

Σ = summation

C_i = C_1 through C_n (C_{10} if 10 measurements are made)



\dot{C}_b = average net background count rate

t_b = time in minutes of a background count

5.2.5 Record the average background counts (\bar{C}_b), the standard deviation (SD_b), and the average background count rate (\dot{C}_b) on the Scaler Instrumentation Background Setup Sheet, Attachment 2.

5.2.6 Calculate the limits for background and record on Attachment 3, Scaler Instrumentation Efficiency Sheet.

High limit $\dot{C}_b + 2SD_b$

Low limit $\dot{C}_b - 2SD_b$ (if less than 0, record 0)

5.3 Instrument Efficiency for Scaler Instruments (E)

Efficiency is a quantitative measure of detector performance for a particular radioisotope. It provides the necessary relationship between counts per minute (cpm) as seen by the detector and disintegrations per minute (dpm) from source decay. Determine detector efficiency with a source of known activity of the nuclide (or of a nuclide with similar energy decay products) being monitored for as follows:

5.3.1 Correct source activity for decay as follows: (if necessary)

$$A = A_0 e^{-\lambda T}$$

$$\text{Where: } \lambda = \frac{0.693}{t_{1/2}}$$

where: A = present source activity.

A_0 = source activity at initial assay.

λ = decay constant for the source isotope.

T = time elapsed since initial source assay*

$t_{1/2}$ = source isotope half-life

*Time units must be consistent (days, hrs., or min., etc.)

5.3.2 Correct source activity for backscatter: (if necessary)

$$A_c = A(1+B_s)$$



where: A_c = corrected activity (dpm)

A = present source activity.

B_s = percent backscatter (expressed as a decimal, i.e., 50% = 0.50 taken from source calibration sheet); $(1+B_s)$ can be found on page 127 of the Radiological Health Handbook.

- 5.3.3** Determine expiration date of source check limits by adding to the current date the value derived from dividing the $t_{1/2}$ of the source by 15. The limits will need to be recalculated in accordance with this section (5.4) after the expiration date.

$$\text{Current date} + (t_{1/2})/15 \text{ (of source)} = \text{Expiration date}$$

If this date is later than the calibration due date record calibration due date as expiration date.

- 5.3.4** Count the source ten times (one minute each) and calculate the standard deviation (SD_n). Record the total counts measured (C_i) on the Instrument Efficiency Determination form, Attachment 3:

$$SD_g = \frac{\sqrt{\sum_i^{10} (C_i - \bar{C}_g)^2}}{N - 1} = \sqrt{\frac{SS}{N - 1}}$$

where: SS = sum of squares

$$SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$$

C_i = gross counts (source counts including background for a single count)

Σ = summation

N = number of measurements

SD_n = standard deviation of the average net counts.

SD_g = standard deviation of the average gross counts

SD_b = standard deviation of the average background counts (obtained from section 5.2)

Record the ten gross counts (C_g) and the standard deviations (SD_n and SD_g) on the Scaler Instrumentation Efficiency Sheet, Attachment 3.

- 5.3.5** Calculate the net count rate (\dot{C}_n):



$$\dot{C}_g = \frac{\bar{C}}{t_g}$$

$$\dot{C}_n = \dot{C}_g - \dot{C}_b$$

where: \dot{C}_g = average gross count rate
 \bar{C}_g = average gross counts
 t_g = time in minutes of a source count
 C_b = average background count rate (obtain from Section 5.2)

Record on Attachment 3.

- 5.3.6** Calculate the detector efficiency (E) for the radioactive standard which equals of best approximates the potential contamination source as follows:

$$E = \frac{\dot{C}_n}{A_c} = \frac{cpm}{dpm}$$

where: \dot{C}_n = average net cpm
 A_c = corrected activity (dpm).

Record on Attachment 3.

- 5.3.7** Calculate the limits for source checks and record on Attachment 3.

$$\text{High limit } \dot{C}_n + 2 SD_n$$

$$\text{Low limit } \dot{C}_n - 2 SD_n$$

5.4 Estimated Minimum Detectable Concentration (MDC) for Scaler Instruments

- 5.4.1** The estimated minimum detectable activity is determined to verify that the detector being used will detect the presence of activity at or above the allowable limit under a given set of counting conditions. MDC is based on the estimated detection limit in counts (L_D) and detector efficiency. Determine the estimated L_D and MDC as follows:

$$L_D = k^2 + 2k\sqrt{B}$$

$$L_D = 3 + 4.65\sqrt{B}$$

Where:

k = Poisson probability sum for α and β (assuming a and b are equal)
= 1.645 for α and β both equal to 0.05 (95% confidence level)

B = number of background counts expect while performing the measurement (background rate x sample count time)

5.4.2 Record the calculated L_D on the Minimum Detectable Concentration Calculation form, Attachment 4.

5.4.3 Calculate the estimated MDC (in dpm/100 cm²). For instances when the background and sample count time are the same:

$$MDC = \frac{L_D}{E \times \frac{A}{100} \times t_b}$$

For instances when the background count time and the sample count time are different:

$$MDC = \frac{3 + 3.29 \sqrt{C_b t_s \left(1 + \frac{t_s}{t_b} \right)}}{E \times t_s \times \frac{A}{100}}$$

Where:

E = total detector 2-pi efficiency (in cpm/dpm) (from Section 5.3.6)

A = detector probe area (in cm²)

t_s = sample count time

t_b = background count time

5.4.4 Record the calculated MDC in on Attachment 4.

5.5 Control Charts

5.5.1 Control charts should be used by the health physics technician to monitor for shifts, trends, or increases in variability. They are used as guides to indicate the need for investigative action, rather than for evaluating precise values.



5.5.1.1 The cpm for each background check should be plotted on a control chart with high and low limits.

5.5.1.2 The net cpm for each source check should be plotted on a control chart with high and low limits.

5.6 Calibration

Instruments used for monitoring and contamination control shall be:

- Periodically maintained and calibrated on an established frequency of at least once per year;
- Appropriate for the type(s), levels, and energies of the radiation(s) encountered;
- Appropriate for existing environmental conditions; and
- Routinely tested for operability.

5.6.1 Radiological instruments shall be used only to measure the radiation for which their calibrations are valid.

5.6.2 The ANSI N323 method for radiological instrumentation calibration will be adhered to.

5.6.3 Calibrations shall use National Institute of Standards and Technology (NIST) traceable sources.

5.6.4 Calibration records shall be maintained on-site and in an electronic project file.

5.6.5 Pocket and electronic dosimeters and area radiation monitors should be calibrated at least annually.

5.6.6 The effects of environmental conditions, including interfering radiation has on an instrument shall be known prior to use.

5.6.7 Functional tests should be used to assess instrumentation designs that include alarms or that involve a process control.

5.6.8 A functional test should be developed to test all components involved in an alarm or trip function and performed at least annually.

5.6.9 Special calibrations should be performed for use of instrumentation outside manufacturer's specifications.

5.6.10 The instrument should be adjusted, calibrated and labeled to identify the special conditions and used only under the special conditions for which it was calibrated.

5.6.11 Instruments should bear a label or tag with the date of calibration and date calibration expires.



5.6.12 For AECOM-owned instruments, the calibration will be performed by a vendor appropriately licensed by the NRC or an Agreement State. Calibrations will be performed at least once annually while the instrument is in service. Rented instruments will also have a valid calibration from a vendor appropriately licensed by the NRC or an Agreement State.

5.7 Receipt of Repaired/Calibrated Instrument

5.7.1 This section applies to instruments sent from a project site out for calibration and returned to the project site. It does not apply to rented equipment received on the project site for the first time.

5.7.2 Verify instrument has the correct calibration due date on the calibration sticker

5.7.3 Place the date the instrument was returned to service in the Out of Service Tracking Log, Attachment 5.

5.7.4 Perform a reference source check of the instrument using the appropriate source.

5.7.4.1 Repeat the procedure provided in Section 5.2 through 5.4 if the instrument's response is outside the original response range.

5.7.4.2 The new background, efficiency, and MDA obtained shall be used as the base line value for that instrument.

5.8 Instruments requiring calibration or repair at an off-site facility, as determined in Section 5.1, are treated as follows.

5.8.1 Remove the instrument from service and record information on instrument check form. In addition, fill out the appropriate information in the Out of Service Tracking Log, Attachment 5.

5.8.2 Instruments with delicate probe windows should have a probe cover secured to prevent damage. Any special instructions should be included with the instrument.

5.8.3 Carefully package the instrument and ship to the calibration facility.



The following Instructions (5.9 – 5.11) are for general guidance only. Project-specific work plans will fully describe survey requirements.

5.9 Using Exposure and Dose Rate Instruments

5.9.1 General Area Surveys

Hold the detector at waist level with the most sensitive areas of the detector facing the item or areas being surveyed. Unless the radiation level on the item being surveyed is known, start on the high scale and work down scale until the instrument reading is between 1/4 and 3/4 (mid-scale) scale, if possible.

5.9.2 Direct Measurements

Hold the detector at about one inch from the surface of the item being surveyed.

5.9.3 Recording a Measurement

Allow the detector to stabilize 15-30 seconds before recording the measurement. If the analog or digital display is sporadic and it difficult to obtain an average response, record 10 instantaneous readings and calculate the average.

5.10 Using Gamma Scintillation Detectors

5.10.1 Direct Measurements

With the detector as close to the surface as possible or some other pre-determined position, collect a measurement for a length of time sufficient to provide an acceptable minimum detectable count rate. Record the measurement on the appropriate field survey form.

5.10.2 Walk-Over Surveys

With the detector as close to the ground as possible, move the detector in a serpentine pattern while advancing along a predetermined survey area transect at a rate of not more than 1 meter per second. For instruments mounted on carts, ensure that the detector height allows sufficient field of view considering the coverage requirements and the spacing of the survey area transect. Record the average and maximum count rates observed for a predetermined survey area or log the data using appropriate survey and position logging instruments.

5.11 Using Beta-Gamma Survey Meters

5.11.1 Counting Smears, Air Sample Filters, and Direct Measurements

Hold the detector no further than 1/2 inch from the smear, filter, or surface. Count smears/filters for a length of time such that the MDA is less than the removable contamination release criterion. Count surfaces for a length of time such that the MDA is less than the total contamination release criterion.



5.11.2 Frisking/scanning

Hold the detector within 1/2 inch of the surface being frisked/scanned. Move the detector no faster than two inches per second. Stop when positive indication is noted from audio response, allow meter indication to stabilize and record that value.

5.12 Using Alpha Survey Meters

5.12.1 Direct Measurements

Hold the detector no further than 1/4 inch from the surface. Count surfaces for a length of time such that the MDA is less than the total contamination release criterion.

5.12.2 Frisking/scanning

Hold the detector within 1/4 inch of the surface being surveyed. Move the detector no faster than two inches per second. Stop when positive indication is noted and allow meter indication to stabilize and record that value.

8.0 RECORDS

- 7.1 Radiological Instrument Daily Instrument Check Record, Attachment 1 or equivalent electronic file
- 7.2 Background Setup Record, Attachment 2 or equivalent electronic form.
- 7.3 Instrument Efficiency Determination, Attachment 3 or equivalent electronic form.
- 7.4 Minimum Detectable Concentration Calculation, Attachment 4 or equivalent electronic form.
- 7.5 Out of Service Tracking Log, Attachment 5 or equivalent electronic form.

ATTACHMENT 1

RADIOLOGICAL INSTRUMENT DAILY SOURCE CHECK RECORD

INSTRUMENT: _____

SERIAL NO.: _____

CALIBRATION DUE DATE: _____

DETECTOR: _____

SERIAL NO.: _____

SOURCE CHECK MATERIAL: _____

SERIAL NO.: _____

ACTIVITY: _____

COUNT TIME: _____

DATE	TIME	BATTERY CHECK	HV SETTING	SOURCE CPM	IN RANGE (Y/N)	TECHNICIAN INITIALS

Reviewed By: _____

ATTACHMENT 2

BACKGROUND SETUP RECORD

Technician:		Date:	
Location:		Project:	
Meter Model	Meter S/N	Detector Model	Detector S/N

Count Time (t_b):	minutes
Measurement #	Counts (C_i)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Average: $\bar{C}_b = \frac{\sum_1^{10} C_i}{N}$	
Standard Deviation: $SD_b = \sqrt{\frac{\sum_i^n (C_i - \bar{C}_b)^2}{N - 1}}$	
$\dot{C}_b = \frac{\bar{C}_b}{t_b}$	cpm
High Limit : $\dot{C}_b + 2SD_b$	cpm
Low limit: $\dot{C}_b - 2SD_b$ (if less than 0, record 0)	cpm

Reviewed By: _____

\bar{C}_b = average background count

SD_b = standard deviation of the average background

N = number of measurements (10)

Σ = summation

C_i = C₁ through C_n (C₁₀ if 10 measurements are made)

\dot{C}_b = average net background count rate

t_b = time in minutes of a background count

ATTACHMENT 3

INSTRUMENT EFFICIENCY DETERMINATION

Technician:		Date:	
Location:		Project:	
Source/Activity:		Source S/N:	
Meter Model	Meter S/N	Detector Model	Detector S/N

Count Time (t):	minutes	Corrected Source 2-pi Activity (A _c):	dpm
Measurement #	Counts Gross	Counts Net	Equations
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Average			$\bar{C} = \frac{\sum_{i=1}^{10} C_i}{N}$
Average Count Rate (\dot{C}_n)			$\dot{C}_n = \frac{\bar{C}}{t}$
2-pi Efficiency (E)			$E = \frac{\dot{C}_n}{A_c} = \frac{cpm}{dpm}$
SD _g (gross)			See Attachment 2
SD _b (background)			See Attachment 2
SD _n (net)			$SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$
Upper Source Check Limit			$\dot{C}_n + 2SD_b$
Lower Source Check Limit			$\dot{C}_n - 2SD_b$

Reviewed By: _____

ATTACHMENT 4

MINIMUM DETECTABLE CONCENTRATION CALCULATION

Technician:		Date:	
Location:		Project:	
Meter Model	Meter S/N	Detector Model	Detector S/N

C _b = Background count rate (from Attachment 2)	cpm
t _b = background measurement count time	minutes
t _s = Sample/direct measurement count time	minutes
B = background counts expected during sample count (C _b x t _s)	counts
Minimum Detectable Count Rate (L _D)	cpm
E = 2-pi Efficiency (see Instrument Efficiency Determination, Attachment 3)	cpm/dpm
Detector Probe Area (A)	cm ²
Minimum Detectable Concentration (MDC)	dpm/100 cm ²

$$L_D = 3^* + 4.65^* \sqrt{B}$$

$$MDC = \frac{L_D}{E \times \frac{A}{100} \times t_b}$$

* - derived constant based on the 95% confidence (α and $\beta = 0.05$)

$$MDC = \frac{3 + 3.29 \sqrt{C_b t_s \left(1 + \frac{t_s}{t_b} \right)}}{E \times t_s \times \frac{A}{100}}$$

Reviewed By: _____

OUT OF SERVICE TRACKING LOG

[illegible]

1. Instrument type
2. Instrument serial number
3. Calibration due date
4. Date removed from service
5. Reason instrument removed from service
6. Date instrument returned from service

Reviewed By:_____

Attachment C



Example Borehole Field Log Sheet

Project #:		Borehole Gamma Survey Downhole Log					
Surveyors Name (Print):				Location: Lockheed -			
Instrument(s) Used		Instrument Setting		Borehole #			
Model	S/N	Instrument Response Check		Date:			
Lud M-2221		Threshold Setting (mV) =		Time:			
Lud M-44-2		High Voltage (V) =		Background (44-2) =		cpm	
Calibration Due :		Battery Check (V) =		Background (44-9) =		cpm	
Lud M-2221		Lud M-2221		Background (44-10) =		cpm	
Lud M-44-9		Lud M-44-10					
Calibration Due :		Calibration Due :					
Borehole Gamma Survey Downhole Log				Core Scan Survey			
Depth Interval (inches)	Gamma Count	Count time	Nal (44-2) (cpm)	GM (44-40) (cpm)	Nal (44-10) (cpm)		
Soil Surface							
0-6							
6-12							
12-18							
18-24							
24-30							
30-36							
36-42							
42-48							
48-54							
54-60							
60-66							
66-72							
72-78							
78-84							
84-90							
90-96							
96-102							
102-109							
Survey (Notes)							
Performed By (Signature) / Date:				Reviewed by (Signature) / Date:			

Attachment D

Example Chain of Custody

Project Name / Site Name:						Sample Analysis Requested													
Client Name:						Number of containers												Comments	Cooler ID
Collected by:																			
Field Sample ID (30 Characters Max)	Date Collected	Time Collected	Sample Depth (beginning - ending)	SA Code ⁽²⁾	Sample Matrix ⁽²⁾														
Comments																			
Custody Transfers Prior to Receipt by Laboratory						Sample Delivery Details / Laboratory Receipt													
Relinquished By (Signed)	Date	Time	Received by (signed)			Date	Time	Delivered Directly to Lab:			Shipped:								
1. _____			1. _____					Method of Shipment:			Airbill #:								
2. _____			2. _____					Analytical Lab:			Location:								
3. _____			3. _____					Lab Recipient:			Date:			Time:					
1.) Sample Type (SA) Codes: N = Normal Sample, TB = Trip Blank (-c) Sample, FD = Field Duplicate (-a) Samples, FR = Field Replicate (-b) Samples, EB = Equipment Blank (-d) Samples, MS = Matrix Spike Samples, SD =																			
2.) Matrix Codes: GS = Soil Gas, WG = Groundwater, WS = Surface Water, SO = Soil, SE = Sediment, SL = Sludge, SS = Surface Soil Samples, WQ = Aqueous Blank Samples (trip, equipment, ambient, etc), SQ = Soil Blanks																			
Page		of		AECOM Project Name															
AECOM Project Number		Project Manager																	
Purchase Order Number		Analytical Data To																	

 Imagine it. Delivered.	Project No. <u>60590868</u> Instruction No. <u>002</u>
	DATE: <u>August 26, 2019</u> APPROVED: 
Radiological Service Technical Practice Group Work Instruction	
Radiological Dose Assessment Monitoring Surveys	
Radiological Service Group Manager	

Work Instruction

RADIOLOGICAL AIR MONITORING, EXPOSURE RATE AND SOIL SCREENING SURVEYS

AECOM DCS's Radiological Service Group (RSG) is responsible for the issuance and execution of this Work Instruction. This Work Instruction is applicable to work conducted in the Technology Enhanced Natural Occurring Radioactive Material (TENORM) areas known as "red mud" areas at the former Lockheed-Martin Alumina Site in St. Croix, United States Virgin Islands (USVI). Any deviations from the instructions set forth in this document require approval of the RSG Manager, Mr. Kevin Taylor, or his designee.

1 PURPOSE

The purpose of this Work Instruction is to provide direction for assessing the impact to workers health and the environment from intrusive work activities in the Alumina site "red mud" areas. These instructions are intended to ensure compliance with AECOM's Radiation Safety Program (S3NA-120-PR1).

2 SCOPE

This instruction provides guidance for screening "red mud soil" well investigation cores for alpha and beta-gamma-emitting radioactivity prior to shipping the samples to a laboratory for analysis and for monitoring workers and the general work area for air-particulate alpha contamination (Thorium-232) (^{232}Th). In addition to the evaluations of potential internal uptake of radioactive materials at each "red mud" drilling location, a gamma count rate and exposure rate survey will be performed with a Ludlum Model 2221/44-10 (2x2) detector and a Ludlum Model 19 micro-roentgen (μR) meter a RSG Senior Health Physicist to assess the external whole body dose to each worker. The Senior Health Physicist will also provide the AECOM site workers with a 4-hour TENORM radiation safety awareness training and 4-hours of radiation safety instrumentation monitoring which includes the use of Eberline (RAS-1) low to medium volume air particulate samplers, a Ludlum Model 3/44-9 Geiger Mueller (GM) pancake detector for alpha and beta borehole core and sample screening and personnel frisk surveys, a Ludlum Model 19 (μR) meter for gamma exposure rate surveys, and a Ludlum Model 2929/43-10-1 alpha and beta sample counter.

3 ALARA POLICY

It is AECOM's policy to plan and conduct its radiological activities safely and to protect the health and safety of its employees, subcontractors, members of the public, and the environment. To achieve this, AECOM shall confirm that efforts are taken to reduce radiological exposures and releases to the environment as low as is reasonably achievable (ALARA), taking into account social, technical, economic, practical and public policy considerations. AECOM's RSG is committed to implementing this policy and supporting AECOM projects in a manner to reflect this policy. An ALARA goal of 1 mrem/day Total Effective Dose Equivalent (TEDE)(Internal plus External dose) limit is being implemented for the project workers with an expected TEDE for the project to be less than 30 mrem per worker.

4 PRECAUTIONS

- 4.1** When handling environmental samples and potentially radioactive materials, always wear protective gloves.
- 4.2** Notify field team management and safety personnel upon the discovery of radioactive materials with greater than the established action levels as documented in the Lockheed Martin Corporation Former St. Croix Alumina Facility Radiological Safety Evaluation Memorandum, August 19, 2019 (Attachment 1).
- 4.3** Refer to RSG procedure CA-SOP 001, *Portable Detection Equipment*, for addition precautions related to working with radiation detection instruments (Attachment 2).

5 WORK INSTRUCTIONS

5.1 Receipt of Instruments

5.1.1 Calibration Verification

- 5.1.1.1 All portable radiological instruments shall have a current calibration label.
- 5.1.1.2 The calibration date will be checked daily prior to use of the instrument.

5.1.2 Physical Check

- 5.1.2.1 Inspect the general physical condition of the instrument and detector prior to each use.
- 5.1.2.2 Inspect for loose, damaged knobs, buttons, cables, connectors, broken/damaged meter movements/ displays, dented or corroded instrument cases, punctured/deformed probe/probe window(s),

cables, etc., and any other physical impairments that may affect the proper operation of the instrument or detector.

- 5.1.2.3 Any instrument or detector having a questionable physical condition shall not be used until corrected.

5.1.3 Initial Background Check

- 5.1.3.1 Move the detector away from known radiation sources.

- 5.1.3.2 Collect ten 1-minute measurements and record each measurement.

- 5.1.3.3 Using an Excel spreadsheet, calculate the following:

- Average background
- Standard deviation
- Average background + three times (3×) the standard deviation (σ) (Attachment 2, Example)

5.2 Daily Instrument Checks

5.2.1 Battery Check

- 5.2.1.1 Check that there is sufficient power being supplied to the detector and instrument circuitry for proper operation.

- 5.2.1.2 Document the battery check in the daily log or on the Radiological Instrument Daily Source Check Record, Attachment 1 of RSG procedure CA-SOP 001 in logbook or equivalent form.

- 5.2.1.3 Perform this check in accordance with RSG procedure CA-SOP 001.

5.2.2 High Voltage (HV) Check

- 5.2.2.1 A HV check is required for instruments with an “HV” check button prior to each use (if applicable).

- 5.2.2.2 Record the HV setting on the Radiological Instrument Daily Source Check Record of RSG procedure CA-SOP 001 in logbook or equivalent form.

5.2.3 Source Check

- 5.2.3.1 Handle the exempt gamma radiation source provided by the RSG with gloved hands or tweezers.
- 5.2.3.2 Perform a source check with the source using reproducible probe/source geometry by collecting a 1-minute measurement
- 5.2.3.3 Record the source check results on the Radiological Instrument Daily Source Check Record of RSG procedure CA-SOP 001 in logbook or equivalent form.
- 5.2.3.4 Compare the source check counts against the response range provided by the RSG. Instruments with source check responses that are outside the acceptable response range two out of three times will be removed from service and the RSG manager will be notified.

5.2.4 Background Check

- 5.2.4.1 Move the detector away from known radiation sources.
- 5.2.4.2 Collect a 1-minute count with the detector and record it in a field logbook or other daily field record forms.

5.3 Screen Environmental Containerized Samples

- 5.3.1 For a sample contained in a sample bag or container, place the survey instrument or detector probe directly on top of the sample and observe the initial detector response (audible response and digital display).
- 5.3.2 **If the response of the instrument is an immediately noticeable increase in beta-gamma count rates or gamma count rates that exceeds two-times (2×) the background (calculated in 5.1.3.3 above), place sample in an unoccupied area, STOP WORK, and notify the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call). If it is determined that the sample does potentially contain low levels of TENORM the lab performing the analysis will be notified.**
- 5.3.3 If the response of the instrument is an immediately noticeable increase in gamma count rates or exposure rates but is less than two-times (2×) the average background, note that the sample potentially contains TENORM and remove it from the sample logging and screening area and other routinely occupied work areas. These samples DO NOT create an exposure hazard for personnel handling the samples. Document all survey results on the form in Attachment 3.

5.4 Screen Environmental Well Borehole Core Samples

- 5.4.1** For well boring test core scans hold the instrument or detector as close to the core as possible (approximately ¼ to ½ inches) without contacting the core. Move the instrument at 1 detector width per second along the length of the core, stopping at locations for 60 seconds where noticeable counts are observed above background. Identify if counts are from possible TENORM contamination (audible response and analog display).
- 5.4.2** If the response of the instrument is an immediately noticeable increase in beta-gamma count rate or exposure rate that exceeds two times (2×) the background (calculated in 5.1.3.3 above), place sample in an unoccupied area, STOP WORK, and notify the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call). If it is determined that the sample does potentially contain low levels of TENORM, the lab performing the analysis will need to be notified.
- 5.4.3** If the response of the instrument is an immediately noticeable increase in beta-gamma count rate or exposure rate but is less than two times (2×) the average background, note the core depth of the elevated reading on the sample logging form. If the results are greater than twice the average background (calculated in 5.1.3.3 above), notify the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call). These samples DO NOT create an exposure hazard for personnel handling the samples. Document all survey results on the forms listed in Section 6, “RECORDS” with examples in Attachment 2.

5.5 External Gamma Radiation and Exposure Rate Survey

5.5.1 Worker External Gamma Exposures

Prior to performing drilling operations, perform gamma exposure rate and gamma count rate surveys at each of the proposed drilling locations (LM). The survey area should be approximately 250 ft² around the drilling location where most of the work will be performed.

5.5.2 Survey Instrumentation

Ensure that all instrumentation is source checked in accordance with section 5.2 and data are recorded on the Radiological Instrument Daily Source Check Record of RSG procedure CA-SOP 001 and in logbook or equivalent form. Perform gamma count rate in counts per minute (cpm) surveys using the Ludlum Model 2221 ratemeter/scaler coupled to a

Ludlum 44-10, NaI (2x2) scintillation detector or equivalent and gamma exposure rate surveys using a Ludlum Model 19 μ R meter.

5.5.3 Survey Performance

Using the Ludlum Model 2221/44-10, perform a survey of a 250 ft² well location area with the detector approximately 3" from the ground surface while walking at a pace of ½ meter per second. Repeat the same survey with the Ludlum Model 19, with the instrument held approximately one meter from the ground surface. In addition, perform a contact exposure rate measurement where the highest gamma count rate or exposure rate was measured. Record the range and average count rates and exposure rates in the field logbook. The gamma exposure rate data will be used to estimate the worker external doses at each borehole location. **If any location identified in the surveyed area exceeds 50 μ R/hr as described in the Lockheed Martin Corporation Former St. Croix Alumina Facility Radiological Safety Evaluation Memorandum, August 19, 2019 (Attachment 1) contact the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call) for instruction on relocation of boring.**

5.6 Air Particulate Monitoring

5.6.1 Sampling Locations

During intrusive work activities in the "red mud" areas, air particulate sampling will be performed using low to medium volume air particulate Eberline RAS-1 samplers. These samplers draw approximately 40 to 70 liters of ambient air per minute (LPM). The collected filter samples will be used to assess worker internal doses to airborne radioactive material, specifically Thorium-232 (²³²Th). Three sample locations will be identified for sampling. One location will be used to assess the daily background airborne activity while the other two sample locations will be performed for each "red mud" borehole drilling location. The location of the samplers to assess worker internal exposures will be located at the Driller Breathing Zone (DBZ) and a General Work Area (GW) which is to be located down-wind of the drilling activity and within 50' of the borehole. The samplers will be checked prior to use for current calibration dates and that calibration paperwork is complete with documentation of indicated flow rate and actual flowrate.

5.6.2 Sampler Setup

The Eberline RAS-1 samplers will be set up each day prior to drilling operations. The background sample location will be in an area that is not

impacted by any operations that are in “red mud” areas. Normally the background sample will be the first sampler setup and ran during the day. A minimum of 40 LPM actual flow for a 6-hour runtime will be required to meet the project airborne radioactivity concentration action level of $2.5E-14$ microcuries per milliliter ($\mu\text{Ci/ml}$) as described in Attachment 1.

5.6.3 Deployment of Samplers

When deploying the air samplers, ensure that they are in a location that will not cause a safety hazard such as a slip, trip, and/or fall. Also, if portable generators are necessary for power, place the generator in a location where the noise is not a safety concern and away from external fuel sources. Ensure that the generator is full of fuel at the initial start-up time.

- 5.6.3.1.1 Place a 47 mm glass fiber acetate (GFA) filter in the sampling head with rough filter side facing out.
- 5.6.3.1.2 Start the pump and record the start time on an air sampling logging form or in the logbook. After a 2-minute warm up period, record the indicated flowmeter reading on the log. This reading should be at a minimum of 60 LPM. **(Note, the actual flow at 60 LPM can be found on the sampler calibration record)**. Record all data on the Record Form in Section 6.5.
- 5.6.3.1.3 At the close of the work day, log the indicated flowmeter reading and log the sampler stop time. Record all data on the Record Form in Section 6.5.
- 5.6.3.1.4 Remove the 47 mm GFA filter from the sampling head and place the filter sample into a glassine envelop. Label the envelope with the sample number, date, and collection start and stop time. Sample number (#) convention will be;
 - Background Samples - LMSC-BKG-xx
 - Driller Breathing Zone - LMSC-DBZ-xx
 - General Work Zone - LMSC-GWZ-xx

5.7 Air Particulate Sample Analysis

- 5.7.1 In order to obtain the accurate alpha air particulate concentrations on samples, the samples will need to be held for three days prior to the final count due to radon accumulation on the filter. After the three-day period, the radon daughters will have decayed and the true gross alpha emitting particles will be retained allowing for subsequent counting measurements.

- 5.7.2 Prior to analyzing air samples with the Ludlum Model 2929/43-10-1 sample counter, perform the daily source check and complete the Radiological Instrument Daily Source Check Record from RSG procedure CA-SOP 001 and document in a logbook or equivalent form.
- 5.7.3 In order to measure the airborne radioactivity for ^{232}Th action level of $2.5\text{E-}14$ $\mu\text{Ci/ml}$, a background and sample count time of 60 minutes is required to ensure the minimum detectable concentration (MDC) is below the project action level of $2.5\text{E-}14$ $\mu\text{Ci/ml}$. Prior to counting daily air samples, perform a 60-minute background count and record the result on the record listed in section 6.5 and 6.7, Air Sample Logging form and Air Sample Data Analysis Sheet.
- 5.7.4 Perform a 60-minute final count on all air samples 3 days after collection and record data results on forms located in Section 6.5 and 6.7, Air Sample Logging Form and Air Sample Data Analysis Sheet.
- 5.7.5 **If any sample result exceeds the $2.5\text{E-}14$ $\mu\text{Ci/ml}$ project action level, contact the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call) to obtain consultation on additional controls that will need to be implemented to ensure all exposures will meet the project ALARA dose goal of 1 mrem per day.**

5.8 Worker Access Control

- 5.8.1 In order to assess worker doses in the “red mud” areas, access to these areas will be controlled. The workers entering and exiting these areas will be required to log their time-in and time-out of the control point to the “red mud” area. In addition, the trained AECOM staff will perform, at a minimum, a hand and foot frisk survey with the Ludlum 44-9 GM pancake survey instrument upon all personnel’s exit. This includes any equipment that may have come into contact with the “red mud” upon removal. **Any sustained counts above the instruments background will require decontamination and require the team to contact the RSG Manager or Health Physicist as soon as possible at 864.517.5639 or 630.632.5819 (text or call)**

6 RECORDS

- 6.1 Maintain a copy of instrument calibration records
- 6.2 Document daily source checks record in Attachment 1, CA SOP-001 in Field logbook or spreadsheet Attachment



Project No. 60590868
Work Instruction No. 002

- 6.3 Maintain daily background measurements in Field Logbook or other daily survey record form (e.g. survey log form or daily source check record in Attachment 2, CA SOP-001.
- 6.4 Radiological Survey Forms (including the bore sampling and core scanning form)
- 6.5 Air Sample Logging Form
- 6.6 Access Control Sign-in/Sign-out Sheet
- 6.7 Air Sample Data Analysis Sheet

Attachments



Project No. 60590868
Work Instruction No. 002

Attachment 1

Radiological Safety Evaluation Memorandum

(August 19, 2019)

&

AECOM Radiation Protection Program (S3NA-120-PR1)



Project No. 60590868
Work Instruction No. 002

Attachment 2

Section 6.0 Record Forms Examples



Project No. 60590868
Work Instruction No. 002

Attachment 3

CA-SOP-001

Portable Detection Equipment

 Imagine it. Delivered.	Project No. Instruction No. <u>003</u>
	DATE: <u>August 26, 2019</u> APPROVED:  Radiological Service Group Manager
Radiological Service Technical Practice Group Work Instruction	
Radiological GPS Enable Gamma Surveys 	

Work Instruction -TERRASYNC BASIC USAGE FOR RADIOLOGICAL SURVEY LOGGING

1.0 GPS Preliminary steps:

- Charge batteries in both Recon and Antenna (receiver).
- Both Battery status can be seen within Terrasync at the top of the screen once you are running. The battery Icon is split lengthwise (Left is for the Antenna, Right is for the Recon).
- Connect the Recon POWERED OFF for charging and if the battery is nearly depleted leave on charge for 4 hours then check its status. *Power up, tap screen to remove owner info, and observe the power icon in the upper right corner.* If not fully charged continue but do not leave on charge for long extended periods as this may damage the battery.
- Charge the Antenna with POWER ON and when the battery light (located on the battery and can be seen thru a small hole in the antenna housing near the back) goes Solid Amber it is fully charged. When the charger is not connected a Solid Green light (on the front panel) is fully charged.
- Set up Antenna pole on the backpack on the same side that you will be surveying with the 2X2 detector when ready to deploy attach the ProXH Antenna to the backpack pole. Attach Ludlum 2221 to the Recon with the RS-232 cable to the instrument and secure cable by tightening the screw with a small flat head screw driver. The 2221 should be set to digital mode not scaler and to slow response. Make sure the instrument window is set to the "OUT" Position. Attached the 2221 to the backpack, speaker out with the three bungee cords. The yellow cord should be run through the strap rings and through the black handle.
- Next connect the Standard Type C, 39" cable to the 2X2 detector and then to the instrument. "Never remove the cable from the detector without shutting off the power of the survey instrument.
- While on site and while driving plug the Recon into the 12 volt plug to maintain battery level. The recon should not be left on when not in use.

2.0 GPS Power up, Almanac, Preliminary steps:

- Power up the Antenna first, just tap the green power button do not hold it down.
- Power up the Recon, just tap the button do not hold it down.
- With the supplied stylus pen tap the screen to remove the Owner Information screen. Tap Start menu, Select Terrasync. The Antenna and the Recon should automatically connect once the program is fully open. Look for an active Icon at the top of the screen (looks like two plugs moving back and forth). You should hear a couple signals and see the "Almanac Received" statement at the top of the screen when they connect.

If you do not see this active plugs icon follow these steps:

- From the top pull down menu (▼) select "Setup" then tap the "GPS" box button to the right of the screen. You should now see the Active Icon at the top with a number which is the number of satellites.
- Now return to the status screen, top pull down and Status.
- You should now see the Almanac massage and see some Satellites populating the screen / connecting. This may take some time depending on the last time the unit was used and how far it has been transported while turned off.

Bluetooth, Serial Connection:

- If you see error messages or failure to connect, open connection manager (icon at the very top of the screen next to the speaker icon) and check the status of the Bluetooth antenna. If it is on turn it off click done at the bottom, then go back in and turn it on and click done. This normally reestablishes the Bluetooth connection.
- If it still will not connect check the port setting. Be sure you have selected the correct com port in Setup, GPS Settings, GPS Receiver Port. The Bluetooth port will read PROXH***** (*serial number of the antenna). To use the cable connection chose the other com port and proceed.

Next:

- The Antenna should be on the side of the backpack in the hand that the detector will be held so that the gamma reading location will be recorded as the X, Y location of the gamma reading. Allow the system to record the almanac and connect with at least 4 (preferably 6+) or more Satellites before proceeding. This is particularly important if the unit has been moved powered down across great distances or if it has been powered off for some time. Note that “Zone” should be changed to the region where work is being performed. (For example in South Carolina the “Zone” is South Carolina 3900). To check the “Zone”, Start Terrasync, select the Status arrow down menu, select setup and then select Coordinate System box. Arrow down and select the Zone (▼) for your location area choices. Select closet location and then select OK to save.

The other menu items in the Coordinate System setup should be set as follows;

- System – US State Plane 1983
- Zone – your work area (South Carolina is South Carolina 3900)(choices can be found be tapping (▼))
- Datum – NAD 1983 (Conus)
- Altitude Reference: Height Above Ellipsoid (HAE)
- Altitude Units: Feet
- Coordinate Units: Feet
- Display USNG: Off
-
- After the Almanac has been recorded to the Recon it is a good time to look at the “PLAN VIEW”. This will allow you to see Satellite geometry into the future and thus predict your best time to work with greatest accuracy.
- From the Status screen tap the second pull down and select PLAN. Here you can automate the next 24 hours or look at the graph at the bottom.

3.0 GPS Logging Features (points on the ground):

- Check your indicated accuracy, it shows up at the top of the screen above the satellite number. 1.8 feet is about as good as it gets.
- Check the real time Waas (SBAS, Airplane) icon, check the base station icon is locked (not flashing). If the real time is still flashing after several minutes you may need to change to “uncorrected GPS” in the setup window under the “Real Time” settings, choice #2 box.
- Top pull down, select “Data”
- Bottom Pull Down, Select “New” if not already there.
- Confirm the settings on this screen
 - File Type = Rover
 - Location = Default
 - File name = **Type the file name you want to use for this file (Lift number/SU/Grid#**
 - Dictionary = Seaview or Generic (seaview has more descriptors)
- Tap “Create” and confirm antenna height at 6’5”.
- Select “Line Generic” (or the term that best suits your application) from the list
- Tap “Create” again, now you should see an icon in the upper right side that looks like a *Red flashing target* (logging Icon) and a small number to the right of it. This shows the number of logged positions for this point and should be increasing every second. If not go to the options pull down menu, select logging interval and then select 1s then OK. Then start your walkover gamma survey. You can pause your survey by tapping the “Pause” button. Resume survey by tapping the “Log” button.

- When survey is completed Tap “OK” and that will save your survey feature. Confirm this action by tapping “OK” and your line survey will be saved or “Cancel and you can continue a new survey feature under the same file name. It is preferred for data management purposes that different lifts, grids or survey units be saved under separate file names.
- Repeat the same steps under a new file name for the next lift, grid or survey unit to be surveyed.

If you have questions please call Eric Olson 864.297.3102 or 864.918.2302 (Cell)
or Steve Shafer 864.234.3047 (office) or 630.632.5819 (cell)

Trimble Recon Settings

Terra Sync - Setup ▼ Menu

Logging - Settings

Log Velocity: No
Log H-Star Data: Auto
Log Super Correct Data: Yes
Antenna Height: 6.5 ft
Allow Position Update: Yes
Confirm End Feature: Yes
File Name Prefix: R
Between Feature Logging
Style: Time
Interval: 1s

Coordinate System

System : US State Plane 1983
Zone : Set to the Area where you area working
DATUM : NAD 1983 (Conus)
Altitude Reference: Height Above Ellipsoid (HAE)
Altitude Units: Feet
Coordinate Units: Feet
Display USNG: Off

GPS Settings

GPS Receiver Port:
COM 8: PROXH, 463149603 (This is the Antenna S#)



Productivity

Precision

▼

DOP Type: PDOP
Max. PDOP: 6.0
Min. SNR: 39.0
Min. Elevation: 15°
Velocity Filter: Off
Receiver Power Output: AUTO
NMEA: Off
RTK precisions: 2 in, 2 in, 4 in, 6 in
Static: (2 in)(2 in) – Drop down menu choices
Roving: (3.9 in)(5.9 in)

Units

Distance: Feet

Area: Square Feet

Velocity: Feet per second

Angle Units: Degrees

Lat/Long Format: DD°MM'SS'.SS''

Offset Format: Horizontal/Vertical

North Reference: True

Magnetic Declination: Auto

Real-Time Settings

Choice 1: Integrated SBAS

Choice 2: Wait for Real Time

Real Time Age Limit: 2 min.

External Sensors

☐

Laser

☒

2221

☐

Sensor 2

▼ **Properties 2221**

Port

COM 1: Serial Cable on Com 1

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: None

Prefix String: Blank

Suffix String: Blank

Max. Bytes: Blank

Time Out: 0.10s

Receive Mode: Unsolicited

Point Feature: 1s

Line/Area Feature: 1s

Not a Feature: Off

Destination Data: Uninterrupted (Attributes)

Assigning Manual Coordinates for Navigation To a “Hot Spot”

This instruction outlines a step by step process that instructs how to set a coordinate for navigation using Trimble’s TerraSync Professional Software.

Note: Before manual coordinate entry, the following considerations and system settings must take place:

- The Coordinate System of the point to which you will navigate must be known.
- TerraSync’s Coordinate System must be set to that of the point’s coordinate system to which you will navigate.

Step By Step Instructions:

- Navigate to the Data menu and create a New Data File if you do not already have an open Data File
- Navigate to the Map menu
- Change the Select tool (Represented by an arrow pointing Up and to the Right) to the Digitize tool **(See Picture 1)**
- Navigate to the Data menu
- Highlight a desired Point Feature
- In the Options menu select Log Later if Log Later is not currently set
- Select a Point Feature you wish to use to enter in coordinates for and selected Create
- Navigate to the Map menu
- In the Options menu select Enter Coordinates
- Enter the Latitude, and Longitude for the Point Feature
- Select OK to accept the coordinates entered
- Navigate to the Data Menu
- Select OK to close out of the Point Feature
- Navigate to the Map menu

Note: The Altitude value entered must be greater than or equal to 1’.

Note: The Point Feature that you have just entered coordinates for should be selected.

- In the Options menu select Set Nav Target and select the Point Feature you wish to Navigate to.

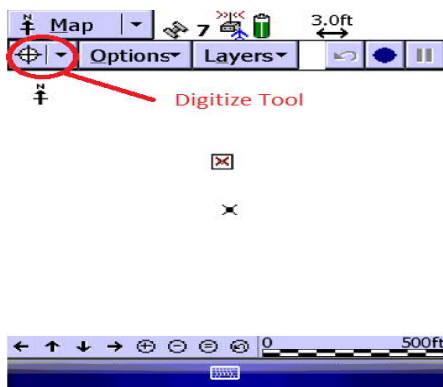
Note: Once the Point Feature has been set as a Nav Target, the symbology of the Point Feature selected will turn into two flags crossing each other.

- Navigate to the Navigation menu

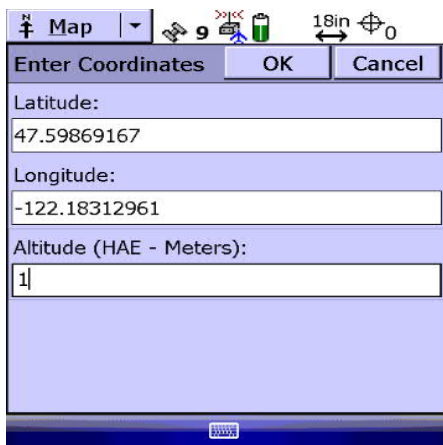
Note: North may not be where you expect it to be. The arrow displayed within the circle will point in the correct direction only when moving... Once you start moving, the software will direct you to your destination.

Keep following the arrow... as you get closer and closer to the Nav Target you set in the Map menu, the Navigation screen will change from an arrow to a screen showing you, represented by an X, approaching the Nav Target.

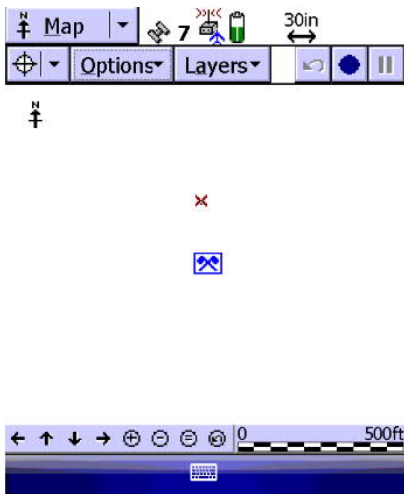
Picture 1



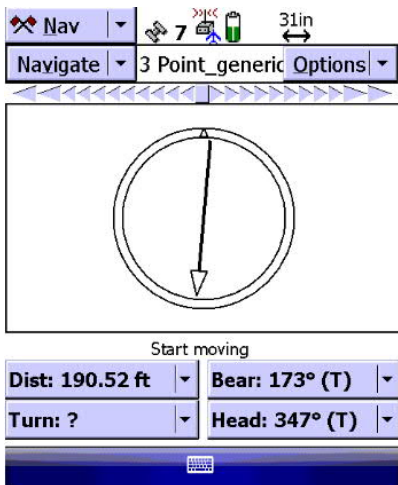
Picture 2



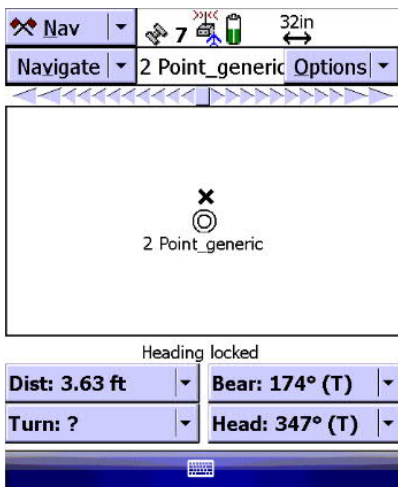
Picture 3



Picture 4




Picture 5



Radiological Procedure - Data Logging/No GPS

Archer Data Field PC Setup

- 1) Use RS-232 cable to couple the Archer Data Field PC to the Ludlum 2221
- 2) Velcro or use zip ties attach data logger to the to the non-speaker side of the Ludlum2221
- 3) Turn on Archer Data Logger by depressing the  on/off button
- 4) Use Stylus and Select the Start menu
- 5) Select 2221 Logger
- 6) The save as menu will appear (provide the following)
 - Name: (Provide a name of the survey unit, this will be your text file name
The default fill name is 2221 Date Time (Suggest using this plus lift or SU #
 - Folder: Select Gamma Data
 - Type: Text (.txt)
 - Location: Main Memory
- 7) Select SAVE
- 8) To start collecting gamma data the Ludlum 2221 must be on slow response and the DIGITAL rate mode selected. Not SCALER
- 9) To start collecting gamma count rate data touch with stylus

Start Recording

Records: # (will show the number of data points collected)

- 10) To Stop or pause recording touch with the stylus

Stop Recording

To restart recording if in pause mode touch the stop recording button and the Start Recording screen will appear.

- 11) To the save the record the recording must be stopped then select the.

OK

Which is in the upper right corner of screen, the logger screen will disappear and the proceed to 5) record another survey.


- 12) Data Removal

Using the grey USB Mini-b cable male end, insert into the female port on the left next to the external power charging port.

- 13) Window Active Sync (4.2)(XP computer) or Windows Device Manager V6.1 (Window 7.0 and above) will automatically detect and connect the data logger to your PC when the USB end of the cable is plugged into your PC. If not select the connection software on your PC.
- 14) Go to My computer or Window File Explorer and select Mobile device logged data will be found in the GAMMA DATA folder.
- 15) Copy logged data file to PC and Open data file (.txt) with Note Pad Software.
- 16) Open a blank Excel Spread Sheet and copy all highlighted data into the 1st cell (Column A, Row 1)
- 17) Now select Data from the drop down menu.
- 18) Select Text to Columns
- 19) Select Delimited
- 20) Select Next
- 21) Select by checking all Delimiters (Tab, semicolon, comma, space, and other if applicable)
- 22) Data is now ready to paste into the gamma survey form.

Radiological Procedure - Data Logging/No GPS

Trimble Recon Data Field PC Setup

- 1) Use RS-232 cable to couple the Archer Data Field PC to the Ludlum 2221
- 2) Velcro or use zip ties attach data logger to the to the non-speaker side of the Ludlum2221
- 3) Turn on Trimble Data Logger by depressing the  on/off button
- 4) Use Stylus and Select the Start menu
- 5) Select File Explorer
- 6) Select 2221 Logger
- 7) The save as menu will appear (provide the following)
 - Name: (Provide a name of the survey unit, this will be your text file name
The default fill name is 2221 Date Time (Suggest using this plus lift or SU #
 - Folder: Select Gamma Data
 - Type: Text (.txt)
 - Location: Main Memory
- 8) Select SAVE
- 9) To start collecting gamma data the Ludlum 2221 must be on slow response and the DIGITAL rate mode selected. Not SCALER
- 10) To start collecting gamma count rate data touch with stylus

Start Recording

Records: # (will show the number of data points collected)

- 11) To Stop or pause recording touch with the stylus

Stop Recording

To restart recording if in pause mode touch the stop recording button and the Start Recording screen will appear.

- 12) To the save the record the recording must be stopped then select the.

OK

Which is in the upper right corner of screen, the logger screen will disappear and the proceed to 5) record another survey.

13) Data Removal

Using the black USB B-type cable insert the male end into the female port to the right of the USB port on the bottom of the Recon opposite the external power charging port.

- 14) Window Active Sync (4.2)(XP computer) or Windows Device Manager V6.1 (Window 7.0 and above) will automatically detect and connect the data logger to your PC when the USB end of the cable is plugged into your PC. If not select the connection software on your PC.
- 15) Go to My computer or Window File Explorer and select Mobile device logged data will be found in the GAMMA DATA folder.
- 16) Copy logged data file to PC and Open data file (.txt) with Note Pad Software.
- 17) Open a blank Excel Spread Sheet and copy all highlighted data into the 1st cell (Column A, Row 1)
- 18) Now select Data from the drop down menu.
- 19) Select Text to Columns
- 20) Select Delimited
- 21) Select Next
- 22) Select by checking all Delimiters (Tab, semicolon, comma, space, and other if applicable)
- 23) Data is now ready to paste into the gamma survey form.