ORAU
OAK RIDGE ASSOCIATED UNIVERSITIES

September 24, 2012

Mr. Theodore Smith
U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
11545 Rockville Pike
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Rockville, MD 20852

SUBJECT: PROJECT-SPECIFIC SURVEY PLAN FOR AAR MANAFACTURING, INC., LIVONIA, MICHIGAN
DCN: 5204-PL-01-0 (RFTA: 12-015)

Dear Mr. Smith,

Oak Ridge Associated Universities (ORAU), working under the Oak Ridge Institute for Science and Education (ORISE) contract, is pleased to provide the enclosed plan for conducting survey activities at the AAR Manufacturing, Inc. site in Livonia, Michigan. The survey has been designed to determine the relationship between sodium iodide detector response and total average thorium concentration in soil.

My contact information is listed below or you may contact Erika Bailey at 865.576.6659 with any questions.

Sincerely,

Erika N. Bailey for

Nick A. Altic
Health Physicist/Assistant Project Manager
Independent Environmental Assessment
and Verification Program

NAA:fr

Enclosure

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PROJECT-SPECIFIC SURVEY PLAN FOR AAR MANAFACTURING, INC., LIVONIA, MICHIGAN

1. INTRODUCTION

The site currently owned and occupied by AAR Manufacturing, Inc. was once owned by the former Brooks and Perkins Company, which manufactured products containing thorium (Th) alloys from 1957 to 1981. In 1959, the Brooks and Perkins Company was issued a license to possess and use 15,000 pounds of thorium. Process operations used a master magnesium-thorium alloy containing 40% thorium to produce alloy products such as HM21 (ingots), consisting of approximately 2% thorium, and HK31 (sheets) of approximately 3% thorium (BKA 1996). The master alloy was heated, melted, and then poured into molds. The castings were removed from the molds, cut, and trimmed after the material had cooled. The scrap metal was recovered, heated and melted, rolled into sheets that were further heated and formed, and then pickled in an acid bath. The final product was sanded, ground, and brushed prior to shipping.

The manufacturing process of thorium magnesium castings began in the Melt Room Area (MRA). The milling and pickling processes of the castings were performed in the Mill Area/Pickling Room (MA/PR) that was adjacent to the MRA. The final processing of the castings was performed in the Finishing Room (FR) that was located immediately west of the MA/PR (BKA 1996).

In 1970, Brooks and Perkins conducted a radiological survey to support termination of their license with the Atomic Energy Commission (AEC), predecessor to the U.S. Nuclear Regulatory Commission (NRC). The radiological survey indicated that the process areas and rooms were found to have residual radioactive material below the 1970 AEC guidelines for unrestricted release. The survey identified contamination outside of the MRA and the Melting and Scalping Rooms. Reportedly, contaminated material from the walkway outside of the MRA had been buried on-site, but this was not substantiated during the initial survey effort (BKA 1996). In 1971, Brooks and Perkins requested and received termination of its license.

AAR purchased the Brooks and Perkins property in 1981. AAR manufactures specialty items

(aluminum cargo containers and related structural supports) for the aircraft industry. In 1994, the NRC conducted an inspection of the site, including interior building surfaces and exterior land areas, and determined that there was Th contamination in both interior and exterior locations. AAR retained B. Koh and Associates, Inc. (BKA) to perform site characterization surveys in 1996 and 1999 and to perform limited remediation in January 2000. Final survey and sampling data for the remediated area were provided to the NRC in March 2000 (BKA 2000).

At NRC's request, Oak Ridge Associated Universities (ORAU), under the Oak Ridge Institute for Science and Education (ORISE) contract, will determine if a relationship between sodium iodide (NaI) instrument response and average total Th concentration can be established. The survey will also include scanning the site boundary to identify if Th contamination is migrating onto bordering properties. The Chessie System Railroad (CSXT) railroad property will not be included in the boundary scan as this property has already been surveyed. Structural scans will also be performed on the concrete floor of the Pickling area and the "New Addition" portions in the manufacturing facility (hereafter referred to as New Addition).

2. FACILITY DESCRIPTION

The AAR site is located at 12633 Inkster Road in Livonia, Michigan, approximately 20 miles northwest of downtown Detroit. The site is bordered on the north by CSXT light commercial developments, on the east by Inkster Road, on the south by train tracks, and on the west by the former Ladbroke Race Track property (now light industrial and commercial property). The site includes a manufacturing facility and a small paint storage building that is centrally located on the site.

The main facility consists of 172,000 ft^2 and houses engineering and administrative offices, the primary manufacturing area, pickling area, materials storage area, and milling area. The adjacent paint storage building has approximately 1,500 ft^2 of area. Originally, two separate buildings (the old commercial building and the mill) occupied the site. During the 1970s, the buildings were connected. The new addition to the mill was added over existing contaminated soil.

3. RADIONUCLIDES OF CONCERN

Based on historical site use and characterization data, the primary radionuclides of concern (ROCs) are thorium-232 (Th-232) and thorium-230 (Th-230) (BKA 1999). Release limits are not discussed as they are not pertinent to the scope of this project.

4. RESPONSIBILITY

Work described in this plan will be performed under the direction of Erika Bailey (Survey Projects Manager) and Nick Altic (Health Physicist) of the Independent Environmental Assessment and Verification Program. The cognizant Field Team Leader has the authority to make appropriate changes to the survey procedures, as deemed necessary and after consultation with NRC personnel. Changes to the scope of the survey plan or procedures will be documented in the site logbook.

5. PROJECT HEALTH AND SAFETY

ORAU will adhere to all applicable regulatory requirements and participate in any required site-specific training. Survey activities will be performed under ORAU's overall health and safety plan (HASP) and radiological protection plan (RPP) during site activities. ORAU is responsible for the overall health and safety of its project personnel. The licensee is expected to inform ORAU of known and potential hazards in order to effectively apply required safety precautions. A walkdown of the project area prior to the survey will assist ORAU in evaluating any additional potential health and safety issues that are not currently addressed in ORAU survey procedures or job hazard analyses (JHAs) (ORAU/ORISE 2012a). Should hazards not covered in the ORAU Survey Procedures Manual or the site HASP be identified, work will not be initiated or continued until it is addressed by an appropriate JHA.

6. DATA QUALITY OBJECTIVES

The data quality objectives (DQO) process provides a formalized method for planning radiation surveys, improving survey efficiency and effectiveness, and ensuring that the type, quality, and quantity of data collected are adequate for the intended decision applications (EPA 2006).

DQO definition, implementation, and assessment are iterative processes because newly collected data may form the basis for redefining the site conceptual model. Examination and analysis of comprehensive data sets (i.e., historical data plus newly collected data for a specific population) may result in the formation of new decisions and objectives, requiring the seven DQO steps be repeated.

The seven steps of the DQO process are as follows:

1. State the problem.
2. Identify the decision/objective.
3. Identify inputs to the decision/objective.
4. Define the study boundaries.
5. Develop a decision rule.
6. Specify limits on decision errors.
7. Optimize the design for obtaining data.

Historical site information and limited survey results provided to ORAU were reviewed and DQOs for this survey effort were developed.

6.1 STATE THE PROBLEM

The relationship between NaI instrument response and Th-232 concentration in soil is unknown. Th-232 concentration is expected to exhibit variability with respect to soil depth, further confounding the relationship. Additionally, it is unknown whether contamination has migrated offsite or whether there is contamination present on the floor surface of the Pickling Area or under the concrete slab of the New Addition to the manufacturing facility. Therefore, the problem statement is as follows:

> *Determine if there is a correlation between NaI detector response and Th-232 concentration, and if contamination has spread offsite, onto the Pickling Area floor, or under the New Addition concrete slab.*

6.2 IDENTIFY THE DECISION/OBJECTIVE

The second step in the DQO process identifies the principal study question (PSQ) and alternate actions (AAs), develops a decision statement, and organizes multiple decisions, as appropriate. This is done by specifying AAs that could result from a "yes" response to the PSQ and combining the

PSQ and AAs into a decision statement. Table 6.1 presents the PSQ and AAs combined into the decision statement.

Table 6.1. Characterization Survey Decision Process	
Principal Study Questions	**Actions**
Can NaI response be used as a predictor of average Th-232 concentration in soil?	**Yes:** Surface scans are acceptable for estimating Th-232 concentration in soil during confirmatory survey activities. **No:** Surface scans are not acceptable for estimating Th-232 concentration in soil; other sampling options must be explored.
Is there contamination at the study area boundary, on the Pickling Area floor, or under the New Addition concrete slab?	**Yes:** NRC may alter remedial action planning to address this contamination. **No:** NRC may not be required to alter remedial action planning to address contamination.
Decision Statements	
Determine the correlation between NaI detector response and Th-232 concentration; determine if there is contamination at the site boundary, on the Pickling Area floor, or under the New Addition concrete slab.	

6.3 IDENTIFY INPUTS TO THE DECISION/OBJECTIVE

Laboratory analysis of soil samples collected during this survey trip will be compared with NaI instrument response at the sample locations. Static NaI measurements will also be collected at soil sample locations to support correlation calculations. The floor monitor may be used with NaI scans to survey the floor of the Pickling area (time permitting). NaI scans will be performed over the New Additional slab. Additionally, data from the 1999 characterization report and the 2004 ORISE confirmatory report may be used to verify the relationship established during the current survey activities (BKA 1999 and ORISE 2004).

6.4 DEFINE THE STUDY BOUNDARIES

Boundaries for the correlation study are limited to the grids tentatively identified for remediation (Solutient 2011). The grids selected for the study are listed in Table 6.2 and will be graphically presented in the ORAU report. For the Pickling Area and New Addition, ORAU will only be allowed approximately three hours to complete all data collection activities.

Table 6.2. Grids Included in Correlation Study Boundary									
Northing	**Grid Numbers**								
36 N	75	100	125	158	218	265	216	281	370
37N	76	101	126	187	219	266	246	282	371
38N	98	123	156	188	247	284	263	368	155
74	99	124	157	189	249	186	264	369	122

6.5 Develop a Decision Rule

Calculate the coefficient of determination (R^2) between NaI response and Th-232 concentration. If R^2 is above the threshold as defined in Section 6.6, then conclude that NaI response can be used as a predictor of Th-232 concentration in soil.

There is no specific decision rule for the Pickling Area and New Addition. The objective is to collect as much data possible in the allotted time and turn the data over to NRC.

6.6 Specify Limits on Decision Errors

Based on the characterization data presented in BKA 1999, the number of required sample locations (33) was calculated such that the average Th-232 concentration would fall within 50% of the characterized mean at the 90% confidence level.

An R^2 value of 0.75 is selected such that 75% of the variation in Th-232 concentration is explained by variation in NaI instrument response.

There are no specified limits on decision errors for the Pickling Area and New Addition.

6.7 Optimize the Design

A ranked set sampling (RSS) approach will be used, following U.S. Environmental Protection Agency (EPA) guidance, to select the soil sample locations. RSS provides a methodology to estimate the mean concentration of a population, but does not require the assumption of a normal distribution. A set size of 3, corresponding to high, medium, and low NaI response, will be used. Specifics as to the number of cycles and required samples were determined using Visual Sample Plan. Based on specified limits on decision errors, resulting in 33 sample locations, and the RSS

approach, there will be 109 ranking locations. Additional details of the survey design are provided in Section 7.

Because one problem is to establish, if possible, a correlation between detector response and Th-232 concentration, judgmental sampling may be required. Gamma walkover data will be reviewed and large gaps in the range of detector responses that are not intrusively sampled using the RSS approach may be selected as judgmental sample locations. For example, if no RSS location represents the 30,000 to 50,000 count per minute range, the Field Lead may direct the collection of a judgmental sample.

Also, to support the correlation, 1-m cores will be collected at each RSS sample location and divided into 0.0-to-0.15-m and 0.15-to-1.0-m intervals. The 0.15-m interval will be analyzed separately as this interval will have the most influence on NaI responses. The balance will be used to create weighted average concentration and determine if the whole depth may also produce an acceptable correlation. Judgmental locations will also include 0.0-to-0.15-m and 0.15-to-1.0-m intervals.

The scan speed in the Pickling Area and New Addition may be increased relative to procedural requirements in order to cover as much area as possible within the temporal constraints.

Analytical count times may be lowered given the already low Th-232 (via progeny) detection limits. This allows for more production of analytical data with negligible loss of quality. Also, the accepted ratio of Th-232 to Th-230 will be used to estimate total thorium concentrations. Otherwise, alpha spectroscopic analysis would be required to produce sufficiently low Th-230 minimum detectable concentrations.

7. SURVEY PROCEDURES

7.1 REFERENCE SYSTEM

ORAU will reference survey results using the reference system established by the licensee and/or specific X, Y coordinates from the southwest corner of the respective survey unit floor and lower left corner of walls, and/or global positioning system coordinates or other prominent site features. Measurement and sampling locations will be documented on detailed survey maps. Specific areas

may also be digitally photographed. The coordinate reference system that will be used is North American Datum 1983 Michigan State Plane with units represented in meters.

7.2 STRUCTURAL SURFACE SCANS

High-density gamma scans will be performed on the floor of the Pickling Area and the New Addition portions of the manufacturing facility. Scans will be performed using NaI detectors coupled to ratemeter-scalers with audible indicators. The purposes of the gamma scans are to identify potential contamination below the concrete in the New Addition and to investigate possible contamination on the floor surface in the Pickling Area.

Time permitting, high-density alpha scans will be performed on the floor in the Pickling Area. Scans will be performed using large-area gas proportional floor monitors, coupled to ratemeter-scalers with audible indicators.

7.4 LAND AREA SURFACE SCANS

High-density surface scans for gamma radiation will be conducted within the bounds of the grids listed in Table 6.2. Scans will be performed using NaI detectors coupled to ratemeter-scalers with audible indicators. Detectors will also be coupled to global positioning systems that enable real-time gamma count rate and position data capture.

7.5 SOIL SAMPLING

Soil samples will be collected sample locations generated by the RSS approach as described in Section 6.7. Soil from the 0.15–1 m interval will be homogenized and a representative aliquot of the homogenized mixture will be collected for analysis. The number of samples collected will be adequate to estimate the mean activity concentration level across study boundary, taking in account the decision errors discussed in Section 6.6. Samples will be collected using hand or power augers (depending on the availability of a generator) and other standard sampling equipment (e.g., stainless steel bowls, trowels, etc.), and equipment will be decontaminated prior to reuse. Samplers will follow the ORAU/ORISE *Survey Procedures Manual* (ORAU/ORISE 2012a) for collecting samples.

8. SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data will be returned to the ORAU/ORISE radiochemistry laboratory in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses will be performed in accordance with the ORAU/ORISE Laboratory Procedures Manual (ORAU/ORISE 2012b). Soil samples will be analyzed by gamma spectroscopy for Th-232 via associated decay products. The spectra will also be reviewed for other identifiable photopeaks. Soil sample results will be reported in units of picocuries per gram (pCi/g). Results will be presented in a draft report and provided to the NRC for review and comment.

9. TENTATIVE SCHEDULE AND REPORTING

- September 24, 2012—NRC approval of survey plan
- September 24-25, 2012—Mobilize to site and begin survey activities.
- September 27, 2012—Complete field survey activities
- 20 business days after receipt of analytical data—Submit draft report to NRC
- 15 days after receipt of comments from NRC—Submit final report

10. REFERENCES

BKA 1996. *Site Characterization Report Former Brooks and Perkins, Inc. Site AAR Manufacturing Group, Inc. Livonia, MI*. B. Koh and Associates, Inc. Owings Mills, Maryland. April.

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EPA 2006. *Data Quality Assessment: Statistical Methods for Practitioners*. EPA QA/G-9S. U.S. Environmental Protection Agency. February.

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Solutient 2011. *AAR Western Parcel Strategic Waste Excavation and Site Restoration for 12633 Inkster Road, Livonia, MI Site*. Draft Remedial Work Plan for Regulatory Review, No. 2011817, Revision 0. Solutient Technologies, LLC. North Canton, Ohio. August 17.