October 16, 2012

Mr. Michael Rigas
U.S. Department of Energy
Oak Ridge Office
P.O. Box 2001
Oak Ridge, TN 37831-0117

DOE CONTRACT NO. DE-AC05-06OR23100
SUBJECT: ADDENDUM TO THE SURVEY REPORT FOR THE
CHARACTERIZATION OF THE FIVE TANKS LOCATED NEAR THE
OLD SALVAGE YARD AT THE Y-12 NATIONAL SECURITY
COMPLEX, OAK RIDGE, TENNESSEE
DCN: 5070-SR-02-0

Dear Mr. Rigas:

Oak Ridge Associated Universities (ORAU), managing the Oak Ridge Institute for Science and Education (ORISE) contract, is pleased to provide this addendum to the final report summarizing characterization activities for the Five Tanks located near the Old Salvage Yard (OSY) at the Y-12 National Security Complex in Oak Ridge, Tennessee. This addendum was necessary to provide additional information required for the disposition of Tank 2, recalling the original ORAU deliverable was data only, per stakeholder agreement.

Please contact me via the information listed below, or David King at 865.574.0685, if you have any questions or require additional information.

Sincerely,

Kathy Rollow
ARRA Program Manager
Independent Environmental Assessment
and Verification Program

KR/fr

Enclosure

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Group Manager Review	TJV

ADDENDUM TO THE SURVEY REPORT FOR THE CHARACTERIZATION OF THE FIVE TANKS LOCATED NEAR THE OLD SALVAGE YARD AT THE Y-12 NATIONAL SECURITY COMPLEX, OAK RIDGE, TENNESSEE

1. BACKGROUND

The purpose of this addendum is to provide clarifying information related to two issues delaying disposal of Tank 2, located west of the Old Salvage Yard at the Y-12 National Security Complex. The two issues are as follows:

1. The discovery and documentation of apparent elevated results on the external rusty surface of Tank 2
2. The proper interpretation and use of scan data

Oak Ridge Associated Universities (ORAU) health physics technicians (HPTs), operating under the Oak Ridge Institute for Science and Education contract, performed 100% scans over accessible interior and exterior surfaces of the five tanks located near the Old Salvage Yard, per the stakeholder-approved project-specific plan (ORAU 2012a). Three types of measurements were collected, including gamma radiation measurements using a Ludlum model 44-10 gamma scintillation detector connected to a Ludlum model 2221 ratemeter/scaler; alpha radiation measurements using a Ludlum model 43-68 gas proportional detector connected to a 2221 ratemeter/scaler; and alpha-plus-beta radiation measurements also using a Ludlum model 43-68 connected to a 2221 ratemeter/scaler. The alpha-plus-beta characterization data is the primary subject of this addendum.

It is also noted the official ORAU deliverable for this project is data. The characterization report presents information in addition to the data, including summaries of activities as planned and as implemented, and briefly describes how unplanned obstacles, such as the discovery of high mercury vapor levels, were addressed. The report is a client-directed “data pump,” and was not intended to provide a narrative of activities or a detailed explanation of the data, which would be expected in a traditional report. Attachment 3 to the report does, however, provide a summary of highlights and daily activities (ORAU 2012b). This addendum is intended to complete the narrative as related to

potential elevated scan results associated with Tank 2 in support of URS | CH2M Oak Ridge LLC (UCOR) efforts to disposition Tank 2.

2. TANK 2 CHARACTERIZATION

On May 16, 2012, two ORAU HPTs began surveys of the Tank 2 exterior using the gas proportional detectors described in Section 1 of this addendum. Both HPTs identified unexpected elevated alpha-plus-beta radiation counts and work was suspended. UCOR called Radiation Controls (RADCON) and radiation control technician (RCT), Larry Thomson, arrived shortly thereafter with a Ludlum model 43-93 scintillation detector. An investigation ensued to determine whether direct measurements would exceed the 5,000 disintegrations per minute (dpm)/100 cm² total surface activity or the 1,000 dpm/100 cm² removable activity limits. No detectable removable activity was encountered, thus focus was directed toward the 5,000 dpm/100 cm² total activity limit. Elevated readings (relative to background) were found mostly near the top of the tank and specifically where the tank had rusted. The ORAU and RADCON RCTs performed surveys across the tank and did not find any direct measurement one-minute-count readings above the 5,000 dpm/100 cm² limit. The maximum reading recorded was 4,900 dpm/100 cm² at location 5070RT205, as reported in ORAU 2012b. RADCON and ORAU instruments generated somewhat different responses as expected with different models, efficiencies, etc., but none produced a single result above ORAU's 4,900 dpm/100 cm² maximum. In fact, the RADCON instrument consistently produced results somewhat lower than the ORAU instruments.

As mentioned, it was the rusted surfaces that exhibited relatively elevated readings. Evidence suggests these readings were due to radon decay products and not contamination associated with site operations. Supporting information is as follows:

- Mr. Thomson mentioned he had previously witnessed elevated responses associated with rust and radon and this seemed to be a similar case.
- Abelquist 2001 specifically notes, "The Po-210 deposition phenomenon seems to be readily observable...on galvanized metal surfaces, in addition to metal that is rusty, oxidized or weathered."
- The *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual*

(*MARSAME*) (DOE et al. 2009) states the following on page B-3: “Pb-210 is a decay product of ^{222}Rn and ^{238}U . The 22-year half-life provides opportunities for buildup of ^{210}Po and progeny in sediment and low-lying areas... Areas where rain collects and concentrates can result in elevated levels of ^{210}Po and progeny over time. In addition, lead is oxidized and can become fixed to surfaces through corrosion processes. Rust or oxide films on equipment can be indicators of locations with a potential for elevated background radioactivity.”

Unfortunately, a suitable background value was not available for completing the counts per minute (cpm) to dpm conversion, and thus the general, though site-specific, background value was used in dpm calculations. Had a similar rusty surface been used to collect background measurements, ORAU believes the background value could have been significantly higher and the associated dpm values proportionally lower.

3. SCAN RESULTS

ORAU recorded scan results (in cpm) using the 43-68s connected to data loggers. Data logging is performed as a means to document what the HPT observed during the surface scanning phase of the radiological survey. The HPT relies upon the audible output to identify and investigate elevated radiation levels in real time. The logged data represent qualitative information relative to the general observed radiation levels, spurious electronic pulses, or environmental factors that may affect count rates. Therefore, ORAU cautions against using these logged data as quantitative results converted to dpm/100 cm². Each logged result represents a detector response collected over a one-second interval, and the model 2221 converts the value from counts per second (cps) to cpm using a multiplier. There is significant error in this conversion and associated results may overestimate actual one-minute-count values. Using the following alpha measurement example can, perhaps, help articulate the nature of the problem.

When performing alpha scans the detector could register 2-to-3 sporadic pulses, which the surveyor hears. The surveyor is instructed to pause the scan at that location to determine whether the pulses are indeed sporadic or are associated with contamination. If no additional pulses are noted the surveyor continues the survey. In this situation the data have been logged and the 3 pulses collected over 1 second can be converted (incorrectly) as 3 cps times

60 s/m = 180 cpm. Where a one minute count could have produced a few counts per minute, the converted 1-second result gives the appearance of 180 cpm that is then converted to a much higher (e.g., 2,000 to 3,000) dpm/100 cm² number.

This alpha measurement example is effectively the same problem observed at Tank 2. Count per second results logged during scans have been converted to cpm then dpm/100 cm² and given the appearance of results above the 5,000 dpm/100 cm² total activity limit. As noted, ORAU HPTs, the ORAU RCT, and RADCON used scan data to *find* locations with potentially elevated levels. They then stopped over the locations of interest and performed one-minute counts. No one-minute count result exceeded 5,000 dpm/100 cm²; thus, the definitive data demonstrate that radiation levels on accessible surfaces of tank interiors and exteriors are below the limit even though the qualitative (scan) data may suggest otherwise.

4. CONCLUSIONS

This problem seems to stem from a breakdown in stakeholder communication. ORAU provided cpm scan data for full disclosure under the assumption it would be used as intended, as a presentation of qualitative data, and not as quantitative data for making disposition decisions. Technical staff have discussed this issue internally and will evaluate methods for presenting and describing qualitative data in future reports. ORAU remains steadfast in its conclusion that the apparently elevated Tank 2 survey results are associated with radon decay products and not site-related contamination. It also believes the direct measurement data presented in ORAU 2012b are the definitive dataset that demonstrate activity levels are below the 5,000 dpm/100 cm² limit, as supported by RADCON findings. Additionally, these data are considered conservatively high, as the background levels for rusty surfaces are lacking.

5. REFERENCES

Abelquist, Eric 2001. *Decommissioning Health Physics – A Handbook for MARSSIM Users*. ISBN 0 7503 0761 7. Institute of Physics Publishing. London.

DOE 2009. *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME)*. DOE/EH-0004, NUREG-1575, Supp. 1, EPA 402-R-09-001. U.S. Department of Energy, U.S. Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. January.

ORAU 2012a. *Project-Specific Plan for Characterization of the Five Tanks Located near the Old Salvage Yard at the Y-12 National Security Complex, Oak Ridge, Tennessee*. DCN: 4858-PL-01-2. Prepared by Oak Ridge Associated Universities for the U.S. Department of Energy—Environmental Management. Oak Ridge, Tennessee. May.

ORAU 2012b. *Survey Report for the Characterization of the Five Tanks located near the Old Salvage Yard at the Y-12 National Security Complex, Oak Ridge, Tennessee*. DCN 5070-SR-01-0. Prepared by Oak Ridge Associated Universities for the U.S. Department of Energy—Oak Ridge Office. Oak Ridge, Tennessee. August.