MEMORANDUM

TO: Argonne National Laboratory – East Work Group
FROM: SC&A, Inc.
DATE: July 17, 2017
SUBJECT: Current Status of ANL-E Site Profile Findings and Observations

Introduction and Background

The most recent editions of the Argonne National Laboratory – East (ANL-E) site profile technical basis documents (TBDs) are as follows:

- ORAUT-TKBS-0036-3, *Argonne National Laboratories – East – Occupational Medical Dose*, Revision 01 PC-1, March 27, 2006
- ORAUT-TKBS-0036-4, *Argonne National Laboratory – East – Occupational Environmental Dose*, Revision 00, February 9, 2006
- ORAUT-TKBS-0036-5, *Argonne National Laboratory – East – Occupational Internal Dose,* Revision 00, March 1, 2006 (also referred to as "TBD-5")
- ORAUT-TKBS-0036-6, *Argonne National Laboratory – East – External Dosimetry*, Revision 01, October 16, 2014 (Revision 01 replaced ORAUT-TKBS-0036-6, Revision 00, of February 9, 2006)

SC&A issued an evaluation report of the ANL-E TBDs in 2009 (SC&A 2009) and an updated report in 2016 (SC&A 2016). SC&A entered the ANL-E site profile primary findings into the Board Review System (BRS) in February 2017.

There was a telephone conference call between the members of the ANL-E Work Group (WG), the National Institute for Occupational Safety and Health (NIOSH), and SC&A on March 10, 2017, to discuss the current status of the ANL-E issues. Members of the WG, NIOSH, and SC&A toured the ANL-E facilities on March 21, 2017.

SC&A entered the ANL-E site profile observations (formally titled "secondary findings"), and also SC&A's response to Primary Findings 3 and 13, into the BRS in April 2017. SC&A informed the ANL-E WG and NIOSH of these entries on the BRS in an email on April 11, 2017.

Current Status of Findings

The following is a brief summary of the current status of the ANL-E site profile findings. Further details are available on the BRS, including discussion of the finding and the resolution of findings that are recommended for closure by SC&A and NIOSH.

Finding 1 – *Potential Missed Dose from Lack of Definition of Radionuclide Compositions and Radionuclides Not Addressed in Site Profile*

NIOSH's response in the BRS on March 8, 2017, indicates that bioassays were sufficiently specific to allow for correct assignment of internal dose from different radionuclides present at ANL-E. However, Research on uranium composition is still underway.

SC&A finds that the current TBD-5, ORAUT-TKBS-0036-5, Revision 00, of March 2006, does not provide adequate coverage of the many different radionuclides that potentially were present at a research lab, such as the percent enrichment of uranium, accelerator-produced radionuclides, and exotic radionuclides. The ability and knowledge needed to monitor for the many possible radionuclides present, especially in the early years, is likely questionable for ANL-E, as it was for other research facilities in the U.S. Department of Energy (DOE) complex at that time.

Finding 2 – *Potential Missed Dose from the Use of Gross Alpha Counting for Bioassay (1946 to 1972)*

According to NIOSH's BRS response of March 8, 2017, the finding that guidance is needed for interpreting results from the gross alpha analysis process is valid, and clearer direction will be provided in the next TBD revision.

Finding 3 – *Assumption of Default Inhalation Pathway May Not Be Claimant Favorable*

SC&A's response of April 4, 2017, on the BRS indicates that this issue has been resolved and recommends closure.

Finding 4 – *Insufficient Information on the Calculation of Minimum Detectable Concentrations (MDC) and Uncertainties in Bioassay Methodology*

According to NIOSH's BRS response of March 8, 2017, the recent records from ANL-E are being reviewed to determine if they may refine the current estimates of MDC in the TBD.

Finding 5 – *Lack of Guidance for Estimation of Missed Dose for Unmonitored Workers*

According to NIOSH's BRS response of March 8, 2017, the potential need for assignment of unmonitored dose is still being assessed.

Finding 6 – *Failure to Adequately Define and Assess Occupational Medical Exposures in the Pre-1988 Years and Potentially Misses Special Employment Exams*

According to NIOSH's BRS response of March 8, 2017, ORAUT-OTIB-0006, *Dose Reconstruction from Occupational Medical X-Ray Procedures*, has been revised (to Revision 04 in 2011) since the original SC&A review and the last revision of the TBD. The ANL-E medical TBD will be evaluated and revised as necessary to incorporate ORAUT-OTIB-0006, Revision 04, recommendations regarding special screening exams.

Finding 7 – *Lacking Techniques and Protocols for Medical Examinations Prior to 1988 Increases the Uncertainty of Dose Conversion Factors Listed in ORAUT-TKBS-0036-3*

SC&A's BRS response of February 13, 2017, indicates that this issue has been resolved and recommends closure. NIOSH's BRS response of March 8, 2017, concurs with this recommendation.

Finding 8 – *Frequencies and Types of X-Ray Exposures Are Uncertain*

According to NIOSH's BRS response of March 8, 2017, any new information collected from ANL-E since the original TBD was written will be incorporated into a revision. ORAUT-OTIB-0006 has been revised (in 2011) since the original SC&A review and the last revision of the TBD. The x-ray information in the ANL-E claim file records constitutes a body of evidence that should be used in the TBD. ORAUT-OTIB-0006 should be used in the absence of such evidence.

SC&A understands this statement to indicate that ORAUT-TKBS-0036-3 will be revised to incorporate the revisions in Revision 04 to ORAUT-OTIB-0006, and, until then, the dose reconstructor is to use the current version of ORAUT-OTIB-0006.

Finding 9 – *Uncertainty and Undocumented Aspects of the Film Dosimetry Need Reexamination*

According to NIOSH's BRS response of March 8, 2017, further research into dosimeter characteristics will be performed to evaluate the similarity of ANL-E dosimeters to those used at Idaho National Laboratory and those used for Argonne National Laboratory–West workers and the validity of the under-response assumptions in the TBD. A simplifying table will be developed to aid dose reconstructors in application of dosimeter parameters.

Finding 10 – *Neutron Dosimetry Is Inadequately Addressed*

According to NIOSH's BRS response of March 8, 2017, NIOSH concurs that improvement of the guidance on neutron monitoring and additional data evaluation are needed.

Finding 11 – *Quantification of External Exposures to Unmonitored Workers Outdoors Is Inadequately Justified*

According to NIOSH's BRS response of March 8, 2017, for the period prior to 1972, use of the average values for other DOE sites in ORAUT-PROC-0060, Revision 01, *Occupational Onsite Ambient Dose Reconstruction for DOE Sites* (June 2006), may be applied as an overestimating assumption because the average doses in that document exceed those at ANL-E for concurrent time periods.

SC&A finds that there should be more detailed information concerning the use of the average values for other DOE sites from ORAUT-PROC-0060 included in the ANL-E ORAUT-TKBS-0036-4 TBD document to ensure consistent application in dose reconstruction.

Finding 12 – *Outdoor Inhalation Exposures Associated with Waste Disposal Operations in Area A and from Particulates Released During Accidents Are Not Adequately Addressed*

NIOSH's BRS response of March 8, 2017, states that according to the TBD (ORAUT-TKBS-0036-2, Section 2.2.2), waste disposal operations at Site A were conducted from 1943 through 1949, with buried waste removed to Site D in 1949. Consequently, all waste disposal operations at Site A were conducted during the period prior to 1954 when the TBD assumptions were considered to be adequate.

SC&A finds that NIOSH's response was supported during the visit to ANL-E on March 21, 2017, and recommends closing the issue.

Finding 13 – *Lack of Consideration of Occupational Radiological Exposure at Site A and Plot M*

SC&A's BRS response of April 4, 2017, indicates that this issue has been resolved and recommends closure.

Current Status of Observations

The following is a brief summary of the current status of the ANL-E site profile observations. Further details are available on the BRS, including discussion of the observations and the resolution of observations that are recommended for closure by SC&A and NIOSH.

Observation 1 – *Potential Missed Dose from Skin and Clothing Contamination*

According to NIOSH's BRS response of April 24, 2017, the TBD will be evaluated and revised to incorporate appropriate language to address dose reconstruction from skin and clothing contamination in accordance with ORAUT-OTIB-0017, Revision 01, *Interpretation of Dosimetry Data for Assignment of Shallow Dose*.

Observation 2 – *Other Potential Medical Exposures Have Not Been Identified*

SC&A's BRS response of April 11, 2017, indicates that this issue has been resolved and recommends closure. NIOSH's BRS response of April 24, 2017, concurs with this recommendation.

Observation 3 – *Additional Factors Contribute to Medical Dose Uncertainties*

SC&A's BRS response of April 11, 2017, indicates that this issue has been resolved and recommends closure. NIOSH's BRS response of April 24, 2017, concurs with this recommendation.

Observation 4 – *Internal Dose to Workers from Radon Exposures Is Not Considered*

According to NIOSH's BRS response of April 24, 2017, no records have been identified that indicate worker monitoring for radon was routinely performed; however, no major sources of enhanced radon exposure have been identified for the ANL-E site. There were no large quantities of uranium or radium in ore stored or handled at ANL-E.

SC&A finds that there were opportunities for exposure to radium-226 (Ra-226), actinium-227 (Ac-227), and thorium. In fact, the ANL-E TBD acknowledges that the site used Ra-226 in Buildings 203 and 211 as part of the accelerator program. In Building 200, radon-200 was produced (ORAUT-TKBS-0036-2, Revision 00 PC-1, Table 2-2). Furthermore, there was a substantial incident involving rupture of an Ra-226 source that generated radon issues through time. Thorium was machined in the East Area and handled in research and development (R&D). Ac-227 was also handled in R&D (Manning 1950). Given the use of radium, actinium, and thorium at ANL-E, further investigation into potential occupational exposures to radon and possibly thoron and actinon are necessary.

Observation 5 – *Lack of Treatment Provided to the Monitoring of Contractors, Transferees, and Visitors*

According to NIOSH's BRS response of April 24, 2017, there is no information in records from ANL-E suggesting that contractors, transferees, or visitors would not have been monitored in accordance with applicable procedures.

SC&A finds that the details of visitor and subcontractor monitoring are lacking. According to page 51 of ORAUT-TKBS-0036-6, rover dosimeters were pocket ionization chambers (PICs) that were not permanently assigned and were typically worn by visitors or personnel who were not normally assigned to an area. Would these PIC doses be recorded for visitors from other DOE facilities, and for the ANL-E workers? The Site Research Database (SRDB) references provided by NIOSH were for the early years at ANL-E, but the majority of the decontamination and decommissioning work would have occurred in later years, perhaps by subcontractors. Have radiation work permits, or similar job plans, been searched for monitoring compliance, especially for subcontractors?

Observation 6 – *Human Radiation Experiments Not Addressed*

According to NIOSH's BRS response of April 24, 2017, doses received from participation in human radiation experiments are considered covered exposure under the Energy Employees Occupational Illness Compensation Program Act; however, they typically have not been

addressed in site TBDs. These doses would be assessed at an individual level based on the information that is available in the documentation (e.g., SRDB Ref. IDs 31911 and 33842).

SC&A finds that while the ANL-E TBDs briefly mention human experiments, they do not explicitly instruct the dose reconstructor to include the doses and where to find the details of some of the human experiments. SRDB Ref. ID 33842, pages 127–147, provides a detailed list of 43 human experiments conducted at ANL-E and should be referenced in the internal dose TBD to provide further information for dose reconstruction. Additionally, SC&A has not seen verification that doses from the human experiments were calculated, recorded, and available in the participants' records.

Observation 7 – *Incidents and Accidents Need to Be Reexamined*

According to NIOSH's BRS response of April 24, 2017, significant incidents and accidents are outlined in Section 2.4 of the site description TBD for ANL-E, with further detail provided in the 1979 Draft Environmental Impact Statement (SRDB Ref. ID 17809), and additional records obtained indicate that radiological incidents are documented at least as early as 1950 in ANL-E program reports.

SC&A finds that these reports only cover accidents during the early period at ANL-E; i.e., pre-1979. Similar research needs to be conducted for 1979 and forward.

References

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