



Memorandum

To: Savannah River Site Work Group

From: John Cardarelli

Subject: NIOSH Response to SC&A paper “Matrix Issues 22 and 23 Regarding Petitioner External Dose Issues”

Date: April 11, 2023

In an SC&A draft memo “Matrix Issues 22 and 23 Regarding Petitioner External Dose Issues” dated January 20, 2011, SC&A defines Savannah River Site (SRS) Special Exposure Cohort (SEC) petition SEC-00103 Matrix Issues 22 and 23 [SC&A 2011]. The two matrix issues are closely related and based on SC&A’s interpretation of worker interviews and petitioner statements.

Matrix Issue 22

SC&A worker interviews suggest that workers kept their badges out of higher radiation areas in order not to exceed dose limits, or sometimes CW would be in radiological situations without knowing it (one incident is described when workers were working with radioactive tools thought initially to be clean) (citation omitted). [SC&A 2011, PDF p. 2]

Matrix Issue 23

Petitioners raise the issue of working conditions with high dose rates when badge dose may have been under-recorded or not recorded (such as weekend work) and/or pencil dosimeters were off-scale, or when there are zero doses in the record. An issue connected to this would be whether the HPAREH [Health Physics Annual Radiation Exposure History] database reflects actual work experience. Petitioners also state that in some cases, workers thought they were working in clean areas that were then determined to be contaminated (citation omitted). [SC&A 2011, PDF p. 2]

In general, the National Institute for Occupational Safety and Health (NIOSH) has addressed the concerns presented in Matrix Issues 22 and 23 with the use of the SRS co-exposure model.

SC&A notes that the adequacy of the external dose records recorded in the HPAREH database for use in co-exposure studies associated with construction workers has been considered and closed as an SEC issue [SC&A 2011, PDF p. 3].

In the process of describing the matrix issues in more detail, SC&A created six numbered topics that appear to be similar to findings. Each numbered topic is identified and summarized below, immediately followed by NIOSH's response.

1. Unmonitored Work in Hot Areas Thought to be Clean

Summary: SC&A provides examples of work in hot areas thought to be clean, but later turned out to be contaminated. One example includes a large construction project above the FB Line occurring between 1984 and 1986 that was treated as a clean area. SC&A provides another example of tools that were inadvertently removed from a radiation area. The tools were brought to a central repair facility in a truck and later found to be contaminated. SC&A also points out that workers in areas assumed to be free of radioactive material may not have been routinely monitored. SC&A acknowledges NIOSH's position regarding the practice of carving clean areas out of radiation control areas to enable construction projects to proceed with little or no personnel monitoring, as detailed in the SEC-00103 Evaluation Report. However, SC&A states that it is unclear whether documentation of these cases exists in workers' individual dose records. SC&A questions how a dose reconstructor would know to look in the Radiation Survey Log Sheets that describe when and where these practices were followed [SC&A 2011, PDF pp. 3–5].

NIOSH Response: NIOSH reaffirms the information provided on clean areas carved out of radiological control areas and agrees that it is unlikely that this kind of information would be included in an individual dose record. Consequently, the dose reconstructor would use a co-exposure model for dose reconstruction for any period of time when monitoring data are not available.

With regard to surface contamination on tools being discovered outside of a zone where contamination control monitoring was routinely required, the fact that contamination was found in this area demonstrates that SRS had monitoring in place that included surveys in areas where radiological operations were not conducted. Surface contamination on tools would not present an external dose problem. Contamination of a magnitude large

enough to present an external dose problem would only exist in very highly-contaminated locations that would be under careful control.

With regard to the FB Line construction project example, SC&A states “It would be useful to examine the dose records of some of the construction workers who worked on the addition above the FB-line to follow-up the information provided by workers regarding unmonitored dose” [SC&A 2011, PDF p. 5]. NIOSH does not agree that such a study is necessary since the co-exposure model is available and is intended for instances in which monitoring data are incomplete or not available. Furthermore, the FB Line construction is only one example; there were other times when work areas were separated to enable construction work.

2. Compromised Badge Readings

Summary: SC&A cites concerns mentioned in worker interviews and in the SEC petition that described common practices that could result in an under-recording or non-recording of external dose. Two of the examples are associated with non-uniform exposure due to badge positioning or shadow-shielding offered by objects in the work area. Two other examples involve inadequate monitoring associated with the use of a “temporary badge” which is one not assigned to a specific individual but instead taken from “a row of leftover badges,” and off-shift workers who worked without monitoring because there were no monitoring badges available. SC&A states “NIOSH has not provided a dose reconstruction approach for such issues that put into question the accuracy of the recorded dose, either because the full extent of the exposure was not recorded or because of practices where badges were not worn or were damaged with possibly unrecorded doses” [SC&A 2011, PDF p. 6].

NIOSH Response: Unless a worker was in a high-radiation area, it would be typical to wear only one badge in a non-uniform exposure scenario. Possible inaccuracies and non-uniform exposure are routinely considered in dose reconstruction procedures. By default, a dose reconstructor assumes 100% anterior-posterior (AP) exposure geometry but has the option to assume rotational or posterior-anterior exposure geometry if Computer Assisted Telephone Interviews (referred to as CATI) or other dose reconstruction guidance prompts the dose reconstructor to change from the default assumption. This information would include the organ of dosimetric interest. *External Dose Reconstruction Implementation Guideline*, OCAS-IG-001 Revision 3 [NIOSH 2007] discusses the assumption of 100% AP exposure geometry and concludes that when associated with the corresponding AP dose conversion factors, the result, in the great majority of cases, does not result in an underestimate of organ dose. The NIOSH-

Interactive RadioEpidemiological Program (referred to as IREP) probability of causation program input parameters account for the uncertainty in measured dose.

Ample evidence of a comprehensive radiation safety program exists at SRS, including monitoring for workers' exposure to external radiation regardless of their employer and position. Visitor badges were available on the badge racks to ensure that workers who did not routinely work in an area (i.e., visitors to the area) were monitored upon entry into the area. These records are available and are included in an individual's personnel monitoring records used for dose reconstruction. Episodes that involved using a temporarily-assigned dosimeter, such as the worker described, could have happened, but based on the weight of the evidence (i.e., number of visitor badges processed) and the attention given to off-normal situations, NIOSH believes this would have been a rare event, not typical of the monitoring practices at SRS. In both examples cited, the workers' records would not have included monitoring results for the period of time in question and the dose reconstructor would apply data from the co-exposure model.

3. Exposure Geometry and Organ Dose Issues

Summary: Workers said they always wore badges on the chest regardless of the exposure direction and said that ring dosimeters were not used when taking samples on the HB and FB Lines.

NIOSH Response: Topic 2 above addresses exposure geometry. As necessary, NIOSH applies geometric corrections to dose reconstructions. For example, NIOSH and the ORAU Team are currently revising ORAUT-OTIB-0017, *Interpretation of Dosimetry Data for Assignment of Shallow Dose* [ORAUT 2005] to include dose relationships that have been assessed at Building 772-F for a cohort of approximately 50 employees performing work as a "decontamination facility attendant." This job involved hands-on work with plutonium and uranium source terms. The co-exposure data were analyzed using the quantile regression methods described in ORAUT-RPRT-0087, *Applications of Regression in External Dose Reconstruction* [ORAUT 2018]. The revised ORAUT-OTIB-0017 (Rev. 02) will include relationships for left-hand and right-hand exposures at the 50th and 95th percentiles for whole body and shallow dose readings.

NIOSH will address non-uniform exposures in *Savannah River Site – Occupational External Dose*, ORAUT-TKBS-0003-6.

4. Pencil Dosimeter Issues

Summary: Workers reported that pencil-dosimeter failures were occasionally handled inconsistently. SC&A notes that pencil dosimeters were not used for dose of record and their investigation did not indicate any evidence of a site-wide systematic effort to ignore high pencil-dosimeter readings. Therefore, issues related to pencil dosimeters were not a significant item.

NIOSH Response: NIOSH concurs.

5. Records of DuPont Operations Workers compared to Construction Trades Workers

Summary: This item cites an example of one worker who claimed to be monitored differently when he worked for DuPont-Construction versus DuPont-Operations. SC&A suggests that NIOSH might conduct a comparison of records of some workers who were in construction trades for some time and also in operations at another separate time, keeping in mind that to be meaningful an investigation will have to include determining external exposure potentials in the different jobs as well as examining the dose records.

NIOSH Response: NIOSH does not believe a comparison is necessary given the status and implementation of *Parameters to Consider when Processing Claims for Construction Trade Workers*, ORAUT-OTIB-0052 [NIOSH 2014]. Monitoring differences and exposure differences are why ORAUT-OTIB-0052 was developed.

6. Overall Petition Challenge to NIOSH

Summary: SC&A quotes a challenge from the President of the Augusta Building and Construction Trades Council to NIOSH, "I want to come from this meeting and look our members in the eyes and say, NIOSH is being fair to us" [SC&A 2011, PDF p. 9].

NIOSH Response: NIOSH conducts its work in a transparent process with oversight provided by the Advisory Board. To ensure that the methods and guidelines NIOSH uses in dose reconstruction are as sound as possible, an independent Advisory Board, appointed by the President of the United States, reviews and comments on the validity and quality of dose reconstructions, dose reconstruction methods, and technical documents.

In cases where radiation exposures in the workplace environment cannot be fully characterized based on available data, default values based on reasonable scientific

assumptions are used as substitutes. NIOSH's dose reconstruction methods consistently give the benefit of the doubt to the claimant whenever there is a question or uncertainty about the amount of radiation exposure the worker may have received. NIOSH provides the public with opportunities to engage in different areas of the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) to ensure the public that their concerns are heard and incorporated into the EEOICPA process.

References

NIOSH [2007]. External dose reconstruction implementation guideline. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. OCAS-IG-001 Rev. 03, November 21. [SRDB Ref ID: 38864]

NIOSH [2014]. Parameters to consider when processing claims for construction trade workers. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. ORAUT-OTIB-0052 Rev. 02, July 24. [SRDB Ref ID: 133862]

ORAUT [2005]. Interpretation of dosimetry data for assignment of shallow dose. Oak Ridge, TN: Oak Ridge Associated Universities Team. ORAUT-OTIB-0017 Rev. 01, October 11. [SRDB Ref ID: 19434]

ORAUT [2018]. Applications of regression in external dose reconstruction. Oak Ridge, TN: Oak Ridge Associated Universities Team. ORAUT-RPRT-0087 Rev. 00, March 13. [SRDB Ref ID: 170100]

SC&A [2011]. Matrix issues 22 and 23 regarding petitioner external dose issues – draft. Letter to Savannah River Site Work Group. Arlington, VA: SC&A. January 20. [SRDB Ref ID: 184209]