Memorandum

To: Subcommittee for Procedure Reviews
From: Kathleen Behling, SC&A, Inc.
Date: April 9, 2026
Subject: SC&A's Reply to the National Institute for Occupational Safety and Health's Response on ORAUT-RPRT-0071 Observations

ORAUT-RPRT-0071, revision 00, "External Dose Coworker Methodology"

September 29, 2023: SC&A submitted its review (SC&A, 2023) of ORAUT-RPRT-0071, rev. 00 (Oak Ridge Associated Universities Team (ORAUT), 2015; "RPRT-0071"). The review identified 10 observations, summarized as follows for context:

- Observation 1. RPRT-0071 does not include estimates of uncertainty
- Observation 2. RPRT-0071 should expand its exploration of mixture models
- Observation 3. Determine the appropriate statistical distribution to use for censored readings in each case individually
- Observation 4. The need to account for relationships between dose and covariates should be considered
- Observation 5. The National Institute for Occupational Safety and Health (NIOSH) does not provide adequate information on how the RPRT-0071 table 1-1 doses were reconstructed
- Observation 6. RPRT-0071 would benefit from a disclaimer in the discussion of linear imputation
- Observation 7. RPRT-0071 should acknowledge the impact of clustering
- Observation 8. RPRT-0071 should provide advice about fitting data that are not lognormal
- Observation 9. RPRT-0071, section 3.0, should expand its discussion of population subsets
- Observation 10. RPRT-0071 does not explicitly describe or address the implications of positive measurement error in the external dose co-exposure model

June 18, 2025: NIOSH issued its response paper, "Response to SC&A's 'Review of ORAUT-RPRT-0071 on External Dose Coworker Methodology'" (NIOSH, 2025). The following summarizes NIOSH's responses:

- **NIOSH Response to Observations 1, 2, 7, 8, and 9:** Although NIOSH generally agreed with the observations, the stated purpose of RPRT-0071 is limited to comparing multiple imputation with one-half the limit of detection (LOD/2) substitution within the co-

exposure framework; therefore, elements such as assessing uncertainty, mixture modeling, clustering, and stratification fall outside the scope of the report.

- **NIOSH Response to Observation 3:** NIOSH concurs. The choice of imputation distribution is made by an Oak Ridge Associated Universities (ORAU) Team statistician and discussed with and reviewed by at least one other ORAU Team statistician and by health physicists. A lognormal distribution is usually appropriate, but the statistician can (and will) consider other distributions if necessary.

- **NIOSH Response to Observation 4:** The dataset used in RPRT-0071 only contains dates, ambiguous worker identification numbers, and doses. Typically, datasets do not contain information to enable the use of covariates. The statistician doing the analysis can consider covariates, if they are available.

- **NIOSH Response to Observation 5:** The dataset provided to the authors of RPRT-0071 contained an "Actual" values column, where results less than the limit of detection (LOD) had been recalculated based on the number of tracks, blank subtraction, and the cycle-specific calibration. The raw data were not made available to the authors. The regression on order statistics used for the imputation model do not use the recalculated values that are <LOD, so the imputation model is not affected by how the doses were recalculated.

- **NIOSH Response to Observation 6:** NIOSH agrees that the linear imputation method is not an appropriate imputation model. It was included in RPRT-0071 for illustrative purposes and as a logical transition from substitution of LOD/2 to an imputation model. A disclaimer could be added in a future revision of RPRT-0071, but the statisticians who perform multiple imputation are aware that the linear imputation method is not appropriate and is no longer used on the project.

- **NIOSH Response to Observation 10:** NIOSH disagrees with the interpretation in observation 10. Measurement error does not cause so many of the measured results to be negative. RPRT-0071 does not address measurement error. Measurement error exists anytime a measurement is made. Because of measurement error, measured doses that are <LOD could have true doses above LOD, and measured doses above the LOD could have true doses that are <LOD. This is true in every analysis and is typically not addressed.

NIOSH presented its responses to the Subcommittee for Procedure Reviews at the January 29, 2026, teleconference meeting. Based on SC&A's review of these responses, SC&A finds that NIOSH's responses adequately address the technical concerns raised, provided that the statisticians applying RPRT-0071 are aware of SC&A's recommendations. SC&A requested confirmation that all statisticians applying RPRT-0071 have reviewed SC&A's observations and recommendations, given their relevance to model selection and data treatment. NIOSH affirmed during the January 29, 2026, meeting that this review has occurred. Therefore, SC&A recommends these observations can be closed specific to RPRT-0071. However, SC&A believes these observations and their implications should continue to be monitored by the Advisory Board on Radiation and Worker Health when evaluating implementation of RPRT-0071 for specific facilities and situations as appropriate.

References

National Institute for Occupational Safety and Health. (2025). *Response to SC&A's "Review of ORAUT-RPRT-0071 on external dose coworker methodology"* [Response paper]. https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-orrpt71-061825-508.pdf

Oak Ridge Associated Universities Team. (2015). *External dose coworker methodology* (ORAUT-RPRT-0071, rev. 00). https://www.cdc.gov/niosh/ocas/pdfs/orau/oraurpts/or-rprt-71-r0.pdf

SC&A, Inc. (2023). *Review of ORAUT-RPRT-0071 on external dose coworker methodology* (SCA-TR-2023-PR071, rev. 0). https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-orrpt71-r0-508.pdf