Summary of Five Document Reviews Approved by the Subcommittee for Procedure Reviews

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Advisory Board on Radiation and Worker Health

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Subcommittee for Procedure Reviews (SPR)-approved documents

- ORAUT-PROC-0095, rev. 00, “Generating Summary Statistics for Coworker Bioassay Data” (“PROC-0095”)
- ORAUT-OTIB-0019, rev. 01, “Analysis of Coworker Bioassay Data for Internal Dose Assignment” (“OTIB-0019”)
- ORAUT-PROC-0065, rev. 00 PC-1, “Internal Finding and Corrective Action to Prevent Recurrence” (“PROC-0065”)
- ORAUT-PROC-0094, rev. 00, “Verification and Validation Process for the Tools Development Group” (“PROC-0094”)
- DCAS-PER-047, rev. 0, “Grand Junction Operations Office” (“PER-047”)

ORAUT-PROC-0095, rev. 00

- Title: “Generating Summary Statistics for Coworker Bioassay Data”
- Revision 00 issued June 5, 2006
- Establishes guidance for coworker (co-exposure) bioassay statistical analyses and provides instruction for:
  - Preparing data in a usable format
  - Generating estimates of 50th and 84th percentiles, geometric mean (GM), and geometric standard deviation (GSD)
  - Validating analysis
- More detailed description of statistical procedures found in ORAUT-OTIB-0019

SC&A's review of ORAUT-PROC-0095

- SC&A reviewed ORAUT-PROC-0095 in October 2007
- SC&A identified three findings
- Findings were discussed at the March 23, 2010, SPR meeting

SC&A's initial (2004) protocol for reviewing procedures and methods

SC&A used seven review objectives for assessing whether the procedure adequately supports the dose reconstruction process. These objectives evaluated the procedure to determine if it:

- Supports a process that is expeditious and timely for dose reconstruction
- Provides adequate guidance to be efficient in instances where a more detailed approach to dose reconstruction would not affect the outcome
- Accounts for all potential exposures and ensures that resultant doses are complete and based on adequate data
- Provides a consistent approach to dose reconstruction regardless of claimants' exposures by time and employment locations
- Ensures fairness and giving the benefit of the doubt to the claimant
- Adequately accounts for the uncertainty of dose estimates
- Strikes a balance between technical precision and process efficiency

ORAUT-PROC-0095 finding 1

Finding date	Finding description	National Institute for Occupational Safety and Health (NIOSH) response	Finding resolution
10/29/2007	Specific guidance for performing the very subjective task of identifying and handling erroneous and/or nonrepresentative data should be identified in the procedure.	**3/23/2010.** Because each data set is unique, with different nomenclatures, units, and formats, it is not possible to proceduralize the identification of errors. A small group of individuals performs all coworker studies so they can draw from their experience when reviewing new data. Identification and resolution of errors are documented in the site-specific coworker Oak Ridge Associated Universities Team (ORAUT) technical information bulletin (OTIB).	**3/23/2010.** SC&A recommended the finding be closed. Identifying data errors is a difficult task requiring expert judgment. NIOSH indicates they are aware of the problem and data errors are documented. SPR agreed and closed the finding.

ORAUT-PROC-0095 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	It is difficult to determine the source and applicability of the OTIB-0019 recommendations regarding goodness of fit. Interpretation of R^2, or coefficient of determination, when there is known conditional dependence and censored data may be seriously over-inflated.	**3/23/2010.** PROC-0095 simply details the calculation of the value, not its interpretation or use. OTIB-0019 addresses the use of the R^2 parameter.	**3/23/2010.** SC&A reviewed and verified that OTIB-0019 did address the concerns raised under its review of PROC-0095. Based on SC&A's review and recommendation, the SPR closed the finding.

ORAUT-PROC-0095 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	PROC-0095 recommends substituting a linear distribution of values for measurements below the minimum detection limit. With linear substitution, the substitute values fall below original data points, indicating linearly spaced substitute values are not claimant favorable.	**3/23/2010.** The linear distribution is not a requirement but was offered as an example of how to deal with datasets with very large percentages of censored data. Since the issuance of PROC-0095, a new report (ORAUT-RPRT-0044) has been developed to better address the issue of censored data.	**3/23/2010.** Based on NIOSH's response, the SPR transferred the finding to the review of ORAUT-RPRT-0044.

ORAUT-PROC-0095 finding 3 follow-up

- SC&A reviewed ORAUT-RPRT-0044, "Analysis of Bioassay Data with a Significant Fraction of Less-Than Results," in November 2010.
- SC&A's review found:
  - Statistical methods proposed in ORAUT-RPRT-0044 are based on sound statistical methodologies.
  - Proposed methods are an improvement over the regression methods proposed in ORAUT-PROC-0095 when:
    - essentially all or most of the data are less-than results,
    - limit of detection was the same for all samples in the dataset, and
    - samples above the limit of detection are randomly spread across workers, job types, and work areas.

Discussion of ORAUT-PROC-0095

ORAUT-OTIB-0019, rev. 01

- Title: “Analysis of Coworker Bioassay Data for Internal Dose Assignment”
- Revision 01 issued October 7, 2005
- Provides technical guidance and assigns responsibilities for analyzing coworker internal bioassay data to develop intake values for assigning dose to unmonitored or partially monitored workers
- Recommended statistical methods are designed to provide an estimate of lognormal distribution parameters and consist of two components:
  - Obtain estimates of a GM and GSD from ranked observations
  - Perform a regression analysis to verify the lognormal distribution provides a good fit to the data

SC&A's review of ORAUT-OTIB-0019

- SC&A reviewed OTIB-0019 in June 2006
- SC&A identified one finding
- SC&A's review discussed at numerous SPR meetings in 2007 and 2008

ORAUT-OTIB-0019 finding 1

- **Finding description**: The OTIB's recommendations for interpreting regression R^2 values do not consider that (1) there is a conditional dependence within the data and (2) there is censored data. R^2 values need to be adjusted to account for conditional dependence.
- **NIOSH response**:
  - The purpose of the R^2 determination in this application is only as a check on assumption that the data are lognormally distributed.
  - In addition, 50th and 84th percentiles are determined from (1) regression analysis and (2) ranked data, as detailed in PROC-0095.
  - The two sets are compared for agreement and used only as an objective determination of how well the data fit a straight line.
  - It was decided that the bioassay values constitute a dataset that are acceptably described by a lognormal assumption.
  - Values below 0.7 may be acceptable but different distributions should be evaluated to determine if the data better fit a different type of distribution.

SC&A follow-up to OTIB-0019 finding 1

- It is not appropriate to:
  1. rank order a set of numbers from low to high,
  2. assign a z-score to the numbers,
  3. fit a line to those numbers,
  4. then derive a correlation coefficient, and
  5. conclude that a high correlation coefficient indicates a good fit to a lognormal distribution.
- SC&A suggests simply rank ordering the numbers and directly plucking off the 50% or 95% value, rather than imposing an artificial distribution on the values.

NIOSH response to follow-up of OTIB-0019 finding 1

- NIOSH finds that the linear fit is superior to rank order analysis.
- The R^2 test confirms that the data have not been corrupted and a linear fit can be used to assign 50th, 84th and 95th percentiles.
- NIOSH conducted a detailed study on 1,771 coworker distributions estimated for a variety of radionuclides at seven facilities. The study confirmed:
  - Estimates of the 84th percentile obtained from the regression model recommended in OTIB-0019 often exceeded the empirical 84th percentile calculated using the ranked method in PROC-0095.
  - The average ratio of the fitted 84th percentile estimate obtained from the best-fitting regression line to the empirical 84th percentile estimate at each facility ranged from 0.97 to 1.40.
  - The lowest reported average ratio of 0.97 was the only ratio less than 1. A ratio greater than 1 is claimant favorable.

OTIB-0019 finding 1 resolution

- Based on the results of the NIOSH study, SC&A recommended that this issue be closed
- SPR closed the finding at its October 14, 2008, meeting

Discussion of ORAUT-OTIB-0019

ORAUT-PROC-0065, rev. 00 PC-1

- Title: “Internal Finding and Corrective Action to Prevent Recurrence”
- Revision 00 PC-1 issued November 3, 2005
- Establishes a methodology to respond to and correct deficiencies identified by employees and/or internal auditors
- Procedure provides a means for:
  - Developing corrective actions or improvement plans
  - Completing the actions/plans on a schedule
  - Addressing preventive measures to ensure process improvements
- Procedure is part of the ORAUT quality assurance (QA) program
- Revision 01 issued April 28, 2011

SC&A's review of ORAUT-PROC-0065

- SC&A reviewed the procedure in June 2006
- SC&A identified two findings
- SC&A's review discussed at the November 7, 2007, SPR meeting

SC&A's procedure to perform QA reviews of NIOSH/ORAUT dose reconstruction procedures

- Evaluation of the Quality Assurance Program Plan (QAPP)
  - Does plan reflect higher-level regulatory and project requirement and good practices?
  - Are responsibilities clearly established?
  - Are there adequate procedures for assuring appropriate training and documentation of records?
- Evaluation of individual procedures and documents
  - Is procedure properly identified by title, number, revision, and date?
  - Has procedure been reviewed and approved by independent reviewers?
  - Are abbreviations, acronyms, and technical terms defined in document?
  - Are scientific and engineering constants, values, equations, and assumptions clearly presented and referenced?

ORAUT-PROC-0065 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	PROC-0065 could benefit from providing a general discussion of how this implementing procedure fits into the overall ORAUT Quality Assurance Program.	**10/7/2007.** NIOSH will determine the value added in SC&A's finding in relation to its impact on project performance.	**10/7/2007.** The SPR considers this issue a suggestion that will be considered by NIOSH in a future revision. Based on NIOSH's response, the SPR closed the finding.

ORAUT-PROC-0065 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Given the length and level of detail of the procedure, including a flowchart that shows the hierarchy of the QA procedures would be helpful to the reader.	**10/7/2007.** NIOSH will determine the value added in SC&A's finding in relation to its impact on project performance.	**10/7/2007.** The SPR considers this issue a suggestion that will be considered by NIOSH in a future revision. Based on NIOSH's response, the SPR closed the finding.

Discussion of ORAUT-PROC-0065

ORAUT-PROC-0094

- Title: “Verification and Validation Process for Tools Development Group”
- Revision 00 issued January 5, 2006
- Establishes a verification and validation process for software tools that are created by the ORAUT Tools Development Group for use in dose reconstruction
- Procedure is part of the quality review process under the ORAUT Quality Assurance Program
- Revision 01 issued September 6, 2017

SC&A's review of ORAUT-PROC-0094

- SC&A reviewed the procedure in October 2007
- SC&A identified one finding with four subparts that required a NIOSH response
- SC&A's review discussed at the December 9, 2008, and November 20, 2017, SPR meetings

ORAUT-PROC-0094 finding 1 subpart 1

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	If ORAUT does not intend the software tools covered in PROC-0094 to be covered by ORAUT-PLAN-0003, "Information Systems Quality Assurance Plan," then it should state its reasoning to avoid possible confusion.	**10/9/2008.** PROC-0094 does adhere to the requirements of ORAUT-PLAN-0003; Section 3.2.3 of PLAN-0003 states that QA processes for software testing are addressed in ORAUT-PLAN-0023, which has subsequently been replaced by ORAUT-PLAN-0026. ORAUT does adhere to PLAN-0026 guidance.	**12/9/2008.** SC&A agrees that PROC-0094 does follow the guidance of ORAUT-PLAN-0003 and recommends that this item be closed. Based on NIOSH's response and SC&A's agreement, the SPR closed the finding.

ORAUT-PROC-0094 finding 1 subpart 2

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	Attachment D flowchart showing the verification and validation steps is not referenced in text.	**10/9/2008.** NIOSH agreed and stated Attachment D will be referenced in section 6.0 of the procedure the next time the procedure is updated.	**12/9/2008.** Based on NIOSH's response, the SPR changed the finding status to in abeyance. **11/20/2017.** NIOSH reported PROC-0094 was revised on 9/6/2017. Attachment D did not significantly add to usability and was removed from procedure. SPR closed the finding.

ORAUT-PROC-0094 finding 1 subpart 3

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	Notes in sections 6.4 and 6.10 should include a statement that, if a test plan is required, only software integrity level 2 applies.	**10/9/2008.** NIOSH agreed and stated that the next revision of the procedure will change the notes in section 6.4 and 6.10 to properly identify the software integrity levels that apply.	**12/9/2008.** Based on NIOSH's response, the SPR changed the finding status to in abeyance. **11/20/2017.** NIOSH reported PROC-0094 was revised on 9/6/2017 and the sections 6.4 and 6.10 notes were appropriately changed. SPR closed the finding.

ORAUT-PROC-0094 finding 1 subpart 4

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	PROC-0094 states, for future revisions to software, only additions/changes will be tested. ORAUT should spot check the performance of the entire software tool whenever any changes are made; this requirement should be in the procedure.	**10/9/2008.** NIOSH disagrees. Dosimetry tools are largely Excel workbooks with some Visual Basic for Applications programming layered in to handle automation that can't be accomplished using Excel functions. Since the majority of tool modifications deal with Excel formulas, the occurrence of errors is limited to items that were modified.	**12/9/2008.** SC&A agrees with NIOSH's reasoning that the entire software tool not be fully rechecked whenever a modification is made. The SPR closed the finding.

Discussion of ORAUT-PROC-0094

DCAS-PER-047, rev. 0

- Title: “Grand Junction Operations Office”
- Issued March 26, 2014
- Assesses the effect of revising the Grand Junction Operations Office (GJOO) dose reconstruction (DR) methodology and DR template
  - Changes resulted from a substantial body of new information being discovered during NIOSH’s evaluation of GJOO Special Exposure Cohort (SEC) petition
- Revisions that could potentially increase doses:
  - External dosimetry data for years between 1982 and 1998 containing 15,000 records with gamma and beta results and a limited number of neutron exposures
  - Source term data for modeling neutron exposures
  - Surrogate exposure data for assigning annual gamma and beta doses to unmonitored workers
  - Air sampling data that included radon measurements

Facility background

- The Grand Junction Facilities (GJF) were located in Grand Junction, CO; covered period 1943–2006
- Formerly known as the Grand Junction Operations Office (GJOO)
- The site was under contract to the U.S. Atomic Energy Commission to support uranium processing, assaying, and milling remediation
- Some limited thorium exposures
- 1986: Start of GJF remedial action project
- 2006: GJF site released
- SEC 1943 through 1985 due to lack of internal dose reconstructability

SC&A's Subtasks 1–3 review of PER-047

- Subtasks 1–3 review of PER-047 issued on February 10, 2015.
- Subtask description:
  1. Identify the circumstances that necessitated the need for PER-047 and ensure that the issues were fully understood and characterized in the program evaluation report (PER).
  2. Assess NIOSH's specific methods for corrective action. When the PER involves a technical issue that is supported by document(s) [e.g., white papers, technical information bulletins (TIBs), procedures] that have not yet been subjected to a formal SC&A review, Subtask 2 will include a review of the scientific basis and/or sources of information to ensure the credibility of the corrective action.
  3. Evaluate the PER's stated approach for identifying the universe of potentially affected DRs and assess the criteria by which a subset of potentially affected DRs was selected for reevaluation.
- SC&A identified four findings and one observation.

DCAS-PER-047 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
2/10/2015	SC&A recommends excluding of non-measurable data for deriving photon dose 95th percentile values for Operators/Laborers, and proportional adjustments for Supervisors and Administrative for years 1985 through 2009.	**4/28/2015.** NIOSH disagrees. The 95th percentile of the full data set (and even just the non-zero data) was not much different than the detection limit itself. These data indicate that the routine external exposure during the time period is low level and including non-measurable data is consistent with other co-exposure models.	**4/28/2015.** SC&A and the SPR found NIOSH's explanation to be acceptable. The SPR closed the finding.

DCAS-PER-047 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
2/10/2015	SC&A recommends the exclusion of neutron dosimeter values below the limit of detection value of 40 millirem for deriving GM and 95th percentile neutron doses for unmonitored GJOO personnel for all years prior to 1985.	**4/28/2015.** As stated in response to finding 1, NIOSH does not believe that it would be appropriate to remove data from the distribution, when there is no evidence that stratification is applicable. Neutron dose is generally associated with geologist using logging sources. Assigning neutron dose to all unmonitored workers is therefore claimant favorable.	**4/28/2015.** SC&A and the SPR found NIOSH's explanation to be acceptable. The SPR closed the finding.

DCAS-PER-047 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
2/10/2015	NIOSH provides neither the raw data nor a documented source for the 569 air sample measurements associated with decontamination and decommissioning (D&D) work for years 1989–2006.	**4/24/2015.** NIOSH identified 15 references that contain the air sample measurements used for calculating doses for the D&D period.	**4/28/2015.** The SPR tasked SC&A to review the references and confirm the data is correct. The status of the finding was changed to in progress, awaiting SC&A's review.

DCAS-PER-047 finding 3 follow-up

Finding date	Finding description	SC&A's response to SPR tasking	Finding resolution
2/10/2015	NIOSH provides neither the raw data nor a documented source for the 569 air sample measurements associated with D&D work for years 1989–2006.	**6/22/2017.** SC&A evaluated all assigned intake values for the D&D period. This evaluation confirmed the use of an air concentration of gross alpha activity of 2.66E-12 microcuries/milliliter, which represents the 95th percentile of 569 air samples from years 1989 through 2001. Recommends closing the finding.	**8/7/2017.** This finding was discussed at a work group (WG) teleconference on GJF, and the WG agreed with SC&A's recommendation to close this finding. The WG sent a note to the SPR that the finding was closed.

DCAS-PER-047 finding 4

Finding date	Finding description	NIOSH response	Finding resolution
2/10/2015	In the derivation of intake rates for radium-226 (Ra-226) and thorium-230 (Th-230), NIOSH failed to employ activity fractions cited in table 3 of the revised GJOO template.	**4/28/2015.** NIOSH agrees that when it assumed the Ra-226 and Th-230 were in equilibrium with uranium for the ore ratios, it set the Ra-226 and Th-230 intake rate equal to the total uranium intakes rate rather than the uranium-234 intake rate alone. This resulted in an overestimate of the Ra-226 and Th-230 intake rates by a factor of two. Template will be revised.	**4/28/2015.** SPR agreed with revising the template, and the status of the finding was changed to in abeyance awaiting the revision.

DCAS-PER-047 finding 4 follow-up

Finding date	Finding description	NIOSH response	Finding resolution
2/10/2015	In the derivation of intake rates for Ra-226 and Th-230, NIOSH failed to employ activity fractions cited in the revised GJOO template.	**1/27/2021.** NIOSH stated the GJOO template was updated with correct ore ratios. However, the template was replaced by a GJF technical basis document (TBD) (ORAUT-TKBS-0060, rev. 00) in May 2018.	**2/18/2021.** SPR closed the finding after SC&A determined that the intake rate error was associated with a timeframe that is now included in an SEC and is no longer relevant. SEC information has been incorporated into the GJF TBD. SPR also tasked SC&A with a full review of the TBD.

DCAS-PER-047 observation 1

Finding date	Observation description	NIOSH response	Finding resolution
2/10/2015	For facilities with no TBD and for which a "template" has been developed, such a template should be made available to SC&A on the NIOSH website without having to obtain a GJOO claimant's dose reconstruction report.	**12/29/2022.** NIOSH presented a discussion of the purpose of the DR methodology templates and stated that templates are not TBDs and unlikely fit the needs for all potential claims at a specific site. Therefore, a DR report that uses a template tailored for the individual claim is the final document to be reviewed.	**12/29/2022.** SPR accepted this philosophy but has since tasked SC&A with reviewing the DR methodology templates along with several claims from the site.

SC&A's Subtask 4 review of PER-047

- Under Subtask 4, SC&A suggested cases be selected to cover employment:
  1. Post-1960
  2. Post-1975 (sample preparation period)
  3. Post-1989 (or the decommission and decontamination period)
- On April 1, 2023, NIOSH provided SC&A with cases A and B
- These cases satisfied the suggested selection criteria

Cases A and B

- Case A was for an energy employee (EE) who worked for a short period during the early operational period (i.e., criterion 1)
- Case B was for an EE who worked for an extended period beginning in 1978 (i.e., criteria 2 and 3)
- SC&A's review was limited to evaluating only those methods and corrective actions related to issues addressed in PER-047

Case A

- EE worked throughout the site
- EE was not monitored for external exposure
- EE had one uranium bioassay
- Initial DR performed in November 2004 with probability of causation (POC) less than 50%
- NIOSH reworked the case in 2013 per DCAS-PER-047

Case A 2004 DR: External dose

- NIOSH assigned an overestimate of external dose by using a dose limit of 3.000 rem per quarter
- NIOSH assigned an overestimate of occupational medical x-ray examination dose using the dose values listed in table 4.0-1 of ORAUT-OTIB-0006, revision 02

Case A 2004 DR: Internal dose

- NIOSH assigned an overestimate of internal dose based on a hypothetical intake, assuming an intake of 28 radionuclides per ORAUT-OTIB-0002, revision 01 (now cancelled)
- EE's positive bioassay result for uranium did not indicate an internal dose greater than that derived from the hypothetical intake
- Resulting POC less than 50%

SC&A's review of Case A 2004 DR

- SC&A found that the original 2004 DR assigned significant overestimates for external, medical x-ray, and internal doses
- SC&A did not find any errors in the 2004 DR report for a DR using significant overestimating methods

Case A 2013 DR: External dose

NIOSH's reworked DR assigned:

- External dose per the dose listed in the GJOO DR methodology document
- A full-year dose of 1.500 rem times the appropriate dose conversion factor (DCF)
- A neutron dose using an overestimating DCF of 1.000, an International Commission on Radiological Protection (ICRP) correction factor of 1.91, at the 50th percentile dose per the GJOO DR methodology document
- An occupational medical x-ray dose per table A-7 of ORAUT-OTIB-0006, revision 04

Case A 2013 DR: Internal dose

- Urinalysis showed activity greater than the level of detection
- Internal intakes of solubility types F, M, and S uranium-234 were developed from the first day of employment through the date of the bioassay
- Activity fractions for “Tailings” were used as a maximizing assumption
- Additional overestimating efficiency included the daily intake rates assigned for the full year
- 2013 rework used:
  - actual urinalysis measurement result to develop chronic uranium intake rates
  - revised methodology for assigning radium and thorium
- Overestimating assumptions were employed in both 2004 and 2013 DRs

SC&A's evaluation of Case A 2013 DR

- SC&A evaluated external dose assignments NIOSH performed in the reworked DR and found them appropriate and correct for an overestimate
- SC&A performed the internal intake calculations and derivation of the internal doses and found them appropriate and correct for an overestimate
- SC&A re-ran the Interactive RadioEpidemiological Program (IREP) and was able to derive a POC that was approximately the same as NIOSH's
- Although external and internal doses were expected to increase due to revisions in the GJOO DR methodology document, doses decreased in the rework due to the significant overestimating approach used in the 2004 DR
- SC&A has no observations or findings for NIOSH's rework of Case A

Case B

- EE had primarily administrative duties and visited the Colorado radium sites
- EE was not monitored for external exposure during the first and latter part of employment but was monitored during the mid part of employment
- EE was not monitored for internal exposure
- Initial 2004 DR resulted in a POC less than 50%
- NIOSH reworked the case in 2014 per DCAS-PER-047

Case B 2004 DR: External dose

Original 2004 DR:

- Used the recorded dose to assign monitored photon dose using an overestimating DCF of 2.0
- Assigned missed photon dose using an overestimate of 12 dosimeter exchanges per year during the monitored period
- Did not assign unmonitored dose for unmonitored periods
- Assessed maximum ambient dose for all years of employment
- Assigned an overestimate of occupational medical x-ray examination dose using the dose values in table 4.0-1 of ORAUT-OTIB-0006, revision 02

Case B 2004 DR: Internal dose

- NIOSH assigned an overestimate of internal dose based on a hypothetical intake, assuming an intake of 28 radionuclides per ORAUT-OTIB-0002, revision 01 (now cancelled)
- Resulting POC less than 50%

SC&A's review of Case B 2004 DR

- SC&A found that the original 2004 DR assigned significant overestimates for external, medical x-ray, and internal doses
- SC&A did not find any errors in the 2004 DR report for a DR using significant overestimating methods

Case B change in modeled organ

- The modeled organ changed in the 2014 DR compared to the 2004 DR due to updated guidance in ORAUT-OTIB-0005, revision 05
- This revision required that both rotational and isotropic exposure geometries be considered in the 2014 DR external dose assignment

Case B 2014 DR: External photon dose

NIOSH's 2014 DR:

- Assigned measured and missed photon dose for the monitored period
- Assigned unmonitored photon dose for the periods the EE was not monitored according to the GJOO DR methodology document
- Did not assign occupational medical x-ray dose because the x-rays were taken off site

Case B 2014 DR: External neutron dose

- EE's U.S. Department of Energy records did not show any positive recorded neutron dose
- NIOSH assigned missed neutron dose using an ICRP correction factor of 1.91 and an overestimate DCF of 1.0
- NIOSH assigned unmonitored neutron dose for the periods the EE was not monitored according to the GJOO DR methodology document

Case B 2014 DR: Internal dose

- EE did not have internal bioassay records from GJOO employment
- NIOSH used inhalation and ingestion intakes for the appropriate worker category listed in table 6 of GJOO DR methodology document
- Based on the EE's duties, unmonitored intakes were assigned using the highest possible annual intake data from table 6
- NIOSH used the selected intake values in the chronic annual dose tool to derive annual internal doses

SC&A's evaluation of Case B 2014 external measured and missed dose

- Measured photon dose: SC&A reviewed the EE's records and NIOSH calculations and concurs with the measured photon dose assignment
- Measured neutron dose: SC&A concurs that the EE's records did not show any positive recorded neutron dose
- Missed photon dose: SC&A reviewed the EE's records and NIOSH calculations and concurs with the missed photon dose assignment
- Missed neutron dose: SC&A reviewed the EE's records and NIOSH calculations and concurs with the missed neutron dose assignment

SC&A's evaluation of Case B 2014 unmonitored photon dose

- SC&A reviewed the EE's dosimetry records and found that the EE was not monitored during some periods of employment
- SC&A derived a total unmonitored photon dose greater than the dose assigned by NIOSH
- This resulted in the identification of one finding

DCAS-PER-047 Subtask 4 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
10/26/2023	SC&A found that NIOSH (1) used the incorrect fraction of an unmonitored year for assigning unmonitored photon dose (over-assignment) and (2) an unmonitored photon dose for only one quarter instead of three quarters for one year (under-assignment).	**3/14/2024.** Finding had to do with prorating of dose for partial years. Error made in this case specifically. Case reworked under DCAS-PER-090 and done correctly. NIOSH assessed other cases done by this dose reconstructor; this was the only one with this issue.	**3/14/2024.** Since NIOSH ensured that this finding was not a systemic issue, SPR closed the finding.

SC&A's evaluation of Case B 2014 unmonitored neutron dose

- SC&A reviewed the EE's dosimetry records and found that the EE was not monitored for neutron exposure during some periods of employment
- SC&A derived a total unmonitored neutron dose greater than the dose assigned by NIOSH
- This resulted in the identification of a second Subtask 4 finding

DCAS-PER-047 Subtask 4 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
10/26/2023	SC&A found that NIOSH (1) used the incorrect fraction of an unmonitored year for assigning unmonitored neutron dose (over-assignment) and (2) an unmonitored neutron dose for only one quarter instead of three quarters for one year (under-assignment).	**3/14/2024.** Finding had to do with prorating of dose for partial years. Error made in this case specifically. Case reworked under DCAS-PER-090 and done correctly. NIOSH assessed other cases done by this dose reconstructor; this was the only one with this issue.	**3/14/2024.** Since NIOSH ensured that this finding was not a systemic issue, SPR closed the finding.

SC&A's evaluation of Case B 2014 internal dose

- SC&A found that the EE was not monitored for internal exposure
- SC&A used the intakes as recommended in the GJOO DR methodology document to derive internal dose
- SC&A derived the same annual internal doses for most of the employment period as NIOSH assigned
- SC&A found that the EE worked part of a year and all of another year for which NIOSH did not assign internal intake
- This resulted in the identification of Subtask 4 finding 3

DCAS-PER-047 Subtask 4 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
10/26/2023	Unmonitored internal doses for two years not assigned. Resulted in several rem of internal dose (but small fraction of total dose) being omitted from the DR.	**3/14/2024**. Error made in this case specifically. Case reworked under DCAS-PER-090 and done correctly. NIOSH assessed other cases done by this dose reconstructor; this was the only one with this issue.	**3/14/2024.** Since NIOSH ensured that this finding was not a systemic issue and this error would not impact the case, SPR closed the finding.

SC&A's evaluation of Case B 2014 radon dose

- GJOO DR methodology document recommends that a sitewide radon intake of 5.7 picocuries per liter be assigned for the most of the EE's employment period
- NIOSH did not assign radon dose
- Radon dose may not have been assigned in this case because of the target organ
- The reason for not assigning radon dose should have been stated in the DR
- This resulted in the identification of Subtask 4 finding 4

DCAS-PER-047 Subtask 4 finding 4

Finding date	Finding description	NIOSH response	Finding resolution
10/26/2023	Radon dose not assigned. According to the GJOO DR methodology document, the EE should have been assigned a radon dose.	**3/14/2024.** Error made in this case specifically. Case reworked under DCAS-PER-090 and done correctly. NIOSH assessed other cases done by this dose reconstructor; this was the only one with this issue.	**3/14/2024.** Since NIOSH ensured that this finding was not a systemic issue and this error would not impact the case, SPR closed the finding.

Summary of SC&A's evaluation of Cases A and B

- SC&A evaluated and verified the external and internal dose assignments NIOSH performed in the reworked DRs
- SC&A re-ran IREP and was able to derive POCs that were approximately the same as NIOSH's derived POCs
- SC&A had no observations but had four findings:
  - **Finding 1:** Unmonitored photon doses for two years appear to be incorrect
  - **Finding 2:** Unmonitored neutron doses for two years appear to be incorrect
  - **Finding 3:** Unmonitored internal doses for two years not assigned
  - **Finding 4:** Radon dose not assigned

SC&A conclusions for DCAS-PER-047 Subtask 4 review

- For each of the two reviewed cases, SC&A provided an overview of the case and a brief comparison of the applicable doses assigned in the original and reworked DRs
- SC&A's audit of these cases focused strictly on external and internal exposures that were affected by the issuance of PER-047
- SC&A found that the doses for Cases A and B (except for the four findings) were reevaluated in accordance with the requirements of PER-047, which addresses changes in the GJOO DR methodology document

Discussion of DCAS-PER-047

ORAUT-OTIB-0052, rev. 01

- Title: “Parameters to Consider When Processing Claims for Construction Trade Workers”
- Revision 01 issued February 17, 2011
- SC&A presented review of ORAUT-OTIB-0052 to the Board March 12, 2013
- Board raised eight questions regarding data in the OTIB and its implementation
- NIOSH will present its response to the ORAUT-OTIB-0052 questions