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**ADVISORY BOARD ON
RADIATION AND WORKER HEALTH**

National Institute for Occupational Safety and Health

OCAS-PER-011, SUBTASK 4

**REVIEW OF SELECT CASES REWORKED FOR THE
EVALUATION OF K-25 TECHNICAL BASIS DOCUMENT AND
TECHNICAL INFORMATION BULLETIN REVISIONS**

**Contract No. 211-2014-58081
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SC&A, INC.: *Technical Support for the Advisory Board on Radiation and Worker Health Review of NIOSH Dose Reconstruction Program*

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ABBREVIATIONS AND ACRONYMS

Advisory Board	Advisory Board on Radiation and Worker Health
CATI	computer-assisted telephone interview
CTW	construction trade worker
DCF	dose conversion factor
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DR	dose reconstruction
DRR	dose reconstruction report
EE	energy employee
ICD	International Classification of Diseases
IREP	Interactive RadioEpidemiological Program
keV	kiloelectron volts
mrem	millirem
NIOSH	National Institute for Occupational Safety and Health
OCAS	Office of Compensation Analysis and Support
ORAUT	Oak Ridge Associated Universities Team
PER	program evaluation report
POC	probability of causation
TBD	technical basis document
TIB	technical information bulletin

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1.0 RELEVANT BACKGROUND INFORMATION

During an Advisory Board on Radiation and Worker Health (Advisory Board) Subcommittee on Procedures Review meeting on July 21, 2012, the Advisory Board tasked SC&A to conduct a review of OCAS-PER-011, *Program Evaluation Report: K-25 TBD and TIB Revisions* (hereafter “PER-011”). PER-011 was initiated following the issuance of a series of technical revisions to the technical basis document (TBD) (ORAUT-TKBS-0009-6) and two ORAUT technical information bulletins (TIBs) (ORAUT-OTIB-0026 and ORAUT-OTIB-0052) that affected K-25 cases. While some changes incorporated into these revisions increased the assigned dose, others resulted in a decrease. Thereafter, PER-011 was necessary to assess cases affected by these document revisions.

In conducting a program evaluation report (PER) review, SC&A is committed to perform five subtasks:

- **Subtask 1:** Assess the National Institute of Occupational Safety and Health’s (NIOSH’s) evaluation and characterization of the “issue” and its potential impacts on dose reconstruction (DR). SC&A’s assessment intends to ensure that the “issue” was fully understood and characterized in the PER.
- **Subtask 2:** Assess NIOSH’s specific methods for corrective action. In instances where the PER involves a technical issue that is supported by documents (e.g., white papers, 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 and its consistency with current and consensus science. Conversely, if such technical documentation has been formalized and previously subjected to a review by SC&A, Subtask 2 will simply provide a brief summary and conclusion of this review process.
- **Subtask 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. The second step may have important implications in instances where the universe of previously denied DRs is very large and, for reasons of practicality, NIOSH’s reevaluation is confined to a subset of DRs that, based on NIOSH’s scientific judgment, have the potential to be significantly affected by the PER. In behalf of Subtask 3, SC&A will also evaluate the timeliness of the completion of the PER.
- **Subtask 4:** Conduct audits of DRs affected by the PER under review. The number of DRs selected for audit for a given PER will vary, based on important elements such as (1) the number of target organs/tissues that may be impacted by a PER, (2) the method and data that were employed in the original DR, and (3) the time period, work location, and job functions that characterize the DR of a claim. (It is assumed that the selection of the DRs and the total number of DR audits per PER will be made by the Advisory Board.)
- **Subtask 5:** Prepare a comprehensive written report that contains the results of the above subtasks, along with SC&A’s review conclusions.

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On April 24, 2013, SC&A submitted to the Subcommittee on Procedures Review SCA-TR-PR2013-0080, *A Review of NIOSH's Program Evaluation Report OCAS-PER-011, K-25 TBS and TIB Revisions*, Revision 0 (SCA 2013). This review satisfied all but the Subtask 4 requirement. At the time the PER-11 review was submitted, SC&A recommended and the Subcommittee agreed that it was necessary to delay the selection of claims until the findings identified in the initial review were resolved by the Subcommittee. This was done because the pool of impacted claims could be affected by the findings' resolution. Resolution of these findings was completed during the May 16, 2016, meeting of the Advisory Board's Subcommittee on Procedures Review. During the meeting, the Subcommittee tasked SC&A to complete Subtask 4 under the review of PER-011.

This report fulfills the requirement defined in Subtask 4 above. The population of claims impacted by documentation changes was limited by the PER to the 432 K-25 claims that were evaluated between November 24, 2004, and August 31, 2006, and had a probability of causation (POC) of less than 50%. This value excludes claims that were subsequently returned to NIOSH for any other reason. According to the PER, NIOSH requested claims that met one of the following two criteria:

- Claims that were completed prior to May 21, 2005, and determined to have been completed using external coworker data
- Claims completed between May 21, 2005, and August 31, 2006, that used external coworker data and were deemed construction trade workers (CTWs)

As discussed in Section 4.2 of SC&A's PER-011 review (SC&A 2013), from the pool of impacted claims, 94 were returned to NIOSH. From the claims returned to NIOSH, only 69 required rework.

Finding 2 from SC&A's initial PER-011 review (SC&A 2013) identified that, "The end date of the first selection criteria, May 21, 2005, is 10 days before the issuance of ORAUT-OTIB-0026 Rev. 00." During issues resolution, this was found to be a typographical error that was carried through PER-011's execution. NIOSH found that two claims were initially completed in that 10-day window of time; however, both claims were reevaluated under the PER.

Following the resolution of the initial review's findings, SC&A recommended the review of four cases from the 69 cases reworked as a result of PER-011. SC&A recommended two cases be selected from each of the following two criteria:

- Claims originally completed before May 31, 2005, using an external coworker model and revised as a result of PER-011
- CTW claims that were originally completed between May 21, 2005, and August 31, 2006, using external coworker data and revised as a result of PER-011

During the May 16, 2016, meeting of the Subcommittee on Procedures Review, the Subcommittee agreed with SC&A's recommendations and tasked SC&A to proceed with Subtask 4. Cases were assigned to SC&A on June 28, 2016.

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The Subcommittee on Procedures Review determined that SC&A's audit of selected DRs should be limited to (1) evaluating those methods and corrective actions introduced in the reworked DRs that relate strictly to issues addressed in OCAS-PER-011 and (2) evaluating applicable documentation and workbooks to ensure they properly reflect the updated coworker guidance. Section 2.0 through Section 5.0 below present SC&A's focused review to determine whether the reworked application of coworker dose was appropriately handled.

2.0 REVIEW OF OCAS-PER-011 ISSUES RELATED TO K-25

In evaluating PER-011, SC&A compared the guidance in ORAUT-OTIB-0052, *Parameters to Consider when Processing Claims for Construction Trade Workers*, Revision 01, for assessing unmonitored CTW coworker dose with the guidance from ORAUT-OTIB-0026, *External Coworker Dosimetry Data for the K-25 Site*, Revision 00 PC-2. For the convenience of the reader, ORAUT-OTIB-0052 guidance is cited below:

Use the guidance in ORAUT-OTIB-0020 (ORAUT 2008) to assign a penetrating dose that is favorable to unmonitored CTWs. Apply an adjustment factor of 1.4 to the appropriate percentile of the measured coworker data for the site, plus the assigned coworker missed dose, to determine the total assigned penetrating dose that is favorable to unmonitored CTWs.

SC&A reviewed ORAUT-OTIB-0026, Revision 00 PC-2, which was issued on November 15, 2006, due to the issuance of ORAUT-OTIB-0052. Revision 00 PC-2 added Table 3 for CTW coworker dose. SC&A found that missed and measured doses are reported in a single value for each percentile of coworker dose and, therefore, an adjustment of 1.4 could not be applied directly. This is equivalent to the way other documents incorporate ORAUT-OTIB-0052 guidance.

PER-011 identified 432 K-25 claims as potentially affected by the series of document revisions. Of these claims, 69 were sent back to NIOSH for revision. SC&A recommended that four claims, two from each category, be assigned to evaluate Subtask 4. NIOSH provided SC&A with Cases [REDACTED] and [REDACTED] that satisfied the first criteria and Cases [REDACTED] and [REDACTED] that satisfied the second criteria.

3.0 BACKGROUND INFORMATION FOR CASE ██████████

Case ██████████ represents an energy employee (EE) who worked at the Oak Ridge Gaseous Diffusion Plant (K-25) from ██████████, 1974, through ██████████, 1985, and the Y-12 Plant from ██████████ 1985, through ██████████ 1994. The EE's job functions during employment were **laborer**, ██████████, and ██████████. The EE was diagnosed with ██████████ of the ██████████ (International Classification of Diseases [ICD]-9 Code ██████████) in 1987 and ██████████ cancer (ICD-9 Code ██████████) in 2007.

3.1 COMPARISON OF NIOSH'S ORIGINAL AND REWORKED DOSE RECONSTRUCTIONS

NIOSH performed the original DR of Case ██████████ in May 2005. The claim was reworked in February 2009 to evaluate the potential for additional dose based on new guidance for processing claims and to include the 2007 ██████████ cancer diagnosis. Both the original and revised DRs stated that the EE's radiation dose was overestimated using efficiency measures. In the original DR, NIOSH calculated a dose of 2.592 rem to the ██████████. Based on this assigned dose estimate, the U.S. Department of Labor (DOL) determined the POC to be 0.43%, and the claim was denied.

Using the most current technical guidance documents, a ██████████ dose of 11.707 rem was recalculated in the revised DR. The revised DR also included a ██████████ dose of 3.434 rem. Table 3-1 compares the original and revised external and internal organ dose estimates for the ██████████ and ██████████. It should be noted that the values cited in Table 3-1 were extracted directly from NIOSH's reworked DR. With the exception of potential coworker external dose at K-25, SC&A has not assessed the accuracy and correctness of these doses, because performing such an assessment is beyond the scope of this Subtask 4 report.

Table 3-1. Comparison of NIOSH-Derived External and Internal Dose Estimates Assigned for the ██████████ and ██████████ in the Original and Reworked DRs

Dose Categories	Previous ██████████ Dose (rem)	Revised ██████████ Dose (rem)	Previous ██████████ Dose (rem)	Revised ██████████ Dose (rem)
External Measured and Missed	0.370	0.679	NA	0.844
External Coworker	0.150	0.835	NA	1.039
Ambient External	0.000	0.727	NA	1.121
Medical X-ray	0.335	0.273	NA	0.003
Internal	1.737	9.194	NA	0.427
Total	2.592	11.707	NA*	3.434

* Not included in previous DR.

Using the EE's U.S. Department of Energy (DOE) records and claimant-favorable assumptions, a ██████████ dose of 11.707 rem and a ██████████ dose of 3.434 rem resulted in a POC of 13.76%. On this basis, the revised claim was denied.

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3.2 SC&A'S REVIEW OF OCAS-PER-011 ISSUES RELATED TO THIS CASE

As directed by the Subcommittee on Procedures Review, SC&A's review of Case [REDACTED] strictly focused on the external coworker model. Case [REDACTED] was included in the pool of claims that required the DR to be reworked because it met the OCAS-PER-011 criteria that (1) the original DR was performed before May 31, 2005, (2) coworker dose was assigned, and (3) the POC was less than 50%.

In the **original** DR, NIOSH identified the years 1974, 1986, and 1987 as times when the EE was not monitored for ionizing radiation and should have been. For these years, NIOSH assigned an unmonitored coworker photon dose of 50 millirem (mrem) per year. This resulted in a total photon unmonitored coworker dose of 0.150 rem to the [REDACTED].

In the **reworked** DR, NIOSH assigned a single year of coworker dose to the year 1974, when the EE was monitored internally. NIOSH used ORAUT-OTIB-0026, Revision 00-PC-2, Table 2, to assign the 50th percentile K-25 coworker dose. NIOSH assumed the EE was exposed to 100% 30–250 kiloelectron volts (keV) photons and applied an organ dose conversion factor (DCF) of 1.000 to modify dose to the [REDACTED] and a DCF of 1.244 to modify dose to the [REDACTED]. NIOSH did not prorate dose to reflect a partial year of employment. This resulted in a photon dose of 0.835 rem to the [REDACTED] and 1.039 rem to the [REDACTED].

In the reworked DR, unlike the original DR, no coworker dose was assigned to 1986 or 1987. This is not addressed in the DR; however, during those years, the EE worked at Y-12. Assessing Y-12 coworker dose is outside the scope of this review; therefore, the discrepancy between the original and reworked DR was not further investigated.

Finding 6: CTW Correction Not Applied

NIOSH did not assume the EE qualified as a CTW. On page 24 of the initial claim document filed by the claimant, the EE indicates that from 1974 through 1975 or 1976, the EE worked as a [REDACTED] laborer. OCAS-PER-014, *Program Evaluation Report: Construction Trades Workers*, Revision 0, another PER that relates to ORAUT-OTIB-0052 recommendations, includes “machinist,” “metal worker,” and “laborer” as job functions that qualify as CTWs. SC&A believes that the EE qualifies as a CTW and that assigning a modified CTW coworker dose would have been appropriate in this case. NIOSH's determination that the EE did not qualify as a CTW resulted in the omission of 0.028 rem to the [REDACTED] and 0.035 rem to the [REDACTED].

SC&A acknowledges that until early 2014, NIOSH incorrectly excluded CTWs working for the prime contractor from receiving CWT adjustments. This exclusion was and remains inconsistent with the ORAUT-OTIB-0052 guidance. NIOSH has committed to addressing this issue in the form of a PER. SC&A suspects CTW adjustments were incorrectly omitted from the DR because the EE worked for prime contractors [REDACTED] and [REDACTED].

4.0 BACKGROUND INFORMATION FOR CASE ██████████

Case ██████████ represents an EE who worked at the Oak Ridge Gaseous Diffusion Plant (K-25) from ██████████, 1947, through ██████████, 1948; from ██████████ 1952, through ██████████, 1961; and from ██████████ 1965, through ██████████, 1981, and at the Y-12 Plant from ██████████, 1961, through ██████████, 1965. The EE was diagnosed with ██████████ (a cancer of the ██████████ ICD-9 code ██████████) in March 2003. The computer-assisted telephone interview (CATI) report and DOE files indicate the EE worked as a ██████████ and ██████████. Although not mentioned in the NIOSH dose reconstruction report (DRR) or CATI report, the NIOSH OCAS Claims Tracking System (NOCTS) also lists the EE as a ██████████ and ██████████ during the years 1965 through 1981.

4.1 COMPARISON OF NIOSH'S ORIGINAL AND REWORKED DOSE RECONSTRUCTIONS

NIOSH performed the original DR of Case ██████████ in December 2004. The claim was reworked in November 2009 based on current practices used in dose reconstruction. This was done to incorporate changes in guidance for K-25 and Y-12 that included coworker dose. Both the original and revised DRs stated that the EE's radiation dose was overestimated using claimant-favorable assumptions. Based on this assigned dose estimate, DOL determined the POC to be 25.16%, and the claim was denied.

Using the most current technical guidance documents and considering CTW coworker dose modifications, NIOSH calculated a ██████████ dose of 22.212 rem in the revised DR. Table 4-1 compares the original and revised external and internal organ dose estimates for the ██████████. It should be noted that the values cited in Table 4-1 were extracted directly from NIOSH's reworked DR. With the exception of external coworker doses, SC&A has not assessed the accuracy and correctness of these doses, because performing such an assessment is beyond the scope of this Subtask 4 report.

Table 4-1. Comparison of NIOSH-Derived External and Internal Dose Estimates Assigned for the ██████████ in the Original and Reworked DRs

Dose Categories	Previous Dose (rem)	Revised Dose (rem)
External Measured and Missed	1.433	0.735
External Coworker	5.541	19.736
Medical X-ray	0.311	0.318
Internal	13.311	1.423
Total	20.520	22.212

Using the EE's DOE records and best-estimate assumptions, a ██████████ dose of 22.212 rem resulted in a POC of 31.95%. On this basis, the revised claim was denied.

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4.2 SC&A'S REVIEW OF OCAS-PER-011 ISSUES RELATED TO THIS CASE

As directed by the Subcommittee on Procedures Review, SC&A's review of Case [REDACTED] is strictly focused on external coworker models. Case [REDACTED] was included in the pool of claims that required the DR to be reworked because it met the OCAS-PER-011 criteria that (1) the original DR was performed prior to the issuance of ORAUT-OTIB-0026, Revision 00 PC-1, on May 31, 2005, (2) the EE coworker dose was assigned, and (3) the POC was less than 50%.

In the **original** DR, NIOSH identified that the EE was likely exposed to external radiation prior to 1980. The EE was assigned average deep doses for K-25 workers from Table 6-4 of ORAUT-TKBS-0009-6, *Technical Basis Document for the K-25 Site – Occupational External Dose*, Revision 00, for each year for which no monitoring was provided. These doses were applied for all years that the EE worked at the K-25 site and were assigned a lognormal or normal distribution. This resulted in a total unmonitored dose of 5.541 rem to the [REDACTED].

In the **reworked** DR, NIOSH identified that the EE may have received unmonitored radiation dose in 1947, 1948, 1952 through 1961, and 1965 through 1981 at K-25. The EE was assigned the 50th percentile coworker dose from Table 2 of ORAUT-OTIB-0026, Revision 00 PC-2. NIOSH assumed the EE was exposed to 100% 30–250 keV photons and applied a DCF of 1.244 to the [REDACTED]. For those years in which the EE was only employed part of the year, the dose was prorated. NIOSH assigned an unmonitored dose of 19.736 rem to the [REDACTED] in the reworked DR.

Observation 1

NIOSH made no adjustments to the DR to account for CTW coworker dose. SC&A notes that the DOE files and NOCTS state that the EE worked as a [REDACTED] and [REDACTED] during the years 1965 through 1981. This is not reflected in the CATI report, initial claim report, or NIOSH DRR; instead, these documents say the EE worked as an [REDACTED] during this time. It is unclear to SC&A where the career designation “[REDACTED]” originated, though SC&A speculates it originated from a DOL-confirmed employment. It is unclear to SC&A if a CTW correction would have been appropriate for 1965 through 1981, though the addition of a CTW correction would not affect compensation.

5.0 BACKGROUND INFORMATION FOR CASE ██████████

Case ██████████ represents an EE who worked at K-25 from ██████████, 1952, through ██████████ 1955, and from ██████████, 1955, through ██████████ 1957. Additionally, the EE worked at the Y-12 Plant from ██████████, 1960, through ██████████, 1960; ██████████ 1960, through ██████████, 1960; ██████████, 1960, through ██████████, 1962; and ██████████, 1962, through ██████████, 1984. The EE was diagnosed with ██████████ of the ██████████ (ICD-9 Code ██████████) in 1979 and ██████████ of the ██████████ (ICD-9 Code ██████████) in 1999.

5.1 COMPARISON OF NIOSH'S ORIGINAL AND REWORKED DOSE RECONSTRUCTIONS

NIOSH performed the original DR of Case ██████████ in February 2006. The claim was reworked in March 2010 to reevaluate this case based on "current methods and procedures." The original DR stated that the EE's radiation dose was overestimated using claimant-favorable assumptions. In the original DR, NIOSH calculated doses of 29.201 rem to the ██████████ on the ██████████ and 14.460 rem to the ██████████ on the ██████████. Based on this assigned dose estimate, DOL determined the POC to be 46.66%, and the claim was denied.

Using the most current technical guidance documents and considering the revised coworker dose methodology, NIOSH recalculated the two ██████████ cancer doses in the revised DR. The revised DR was completed with best estimate assumptions. Table 5-1 compares the original and revised external and internal organ dose estimates for the ██████████. It should be noted that the values cited in Table 5-1 were extracted directly from NIOSH's reworked DR. With the exception of external coworker dose, SC&A has not assessed the accuracy and correctness of these doses, because performing such an assessment is beyond the scope of this Subtask 4 report.

Table 5-1. Comparison of NIOSH-Derived External and Internal Dose Estimates Assigned for the ██████████ in the Original and Reworked DRs

Dose Categories	Previous ██████████ Dose (rem)	Revised ██████████ Dose (rem)	Previous ██████████ Dose (rem)	Revised ██████████ Dose (rem)
External Measured and Missed	8.850	9.154	9.048	9.996
External Coworker	0.720	1.724	0.720	1.845
Medical X-ray	18.585	26.132	3.483	2.155
Internal	0.176	0.472	0.519	1.020
Total	29.201	37.482	14.640	15.016

Using the EE's DOE records and claimant-favorable assumptions, a ██████████ dose of 37.482 rem to the ██████████ and 15.016 rem to the ██████████ resulted in a POC of 51.98%. On this basis, the revised claim was **compensated**.

5.2 SC&A'S REVIEW OF OCAS-PER-011 ISSUES RELATED TO THIS CASE

As directed by the Subcommittee on Procedures Review, SC&A's review of Case ██████████ strictly focused on external coworker models. Case ██████████ was included in the pool of claims

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that required the DR to be reworked because it met the PER-011 criteria that (1) original DR was completed between May 21, 2005, and August 31, 2006, (2) the EE worked as a construction trade worker, (3) coworker dose was assigned, and (4) the POC was less than 50%.

In the **original** DR, NIOSH identified that the EE was potentially exposed to external photons and electrons during 1957 but was unmonitored for external exposure. NIOSH assumed the EE was likely exposed to 100% 30–250 keV photons and assumed a DCF equal to 1.00. No photon adjustment factor was applied. NIOSH assigned each cancer the 50th percentile coworker photon dose in 1957 from Table 2 of ORAUT-OTIB-0026, Revision 00 PC-1. This resulted in the total coworker photon dose of 0.720 rem to each cancer site.

In the **reworked** DR, NIOSH identified that the EE was unmonitored in 1957. Based on elevated dosimetry values in 1956, NIOSH assumed the EE was exposed to the 95th percentile gamma and non-penetrating values from Table 2 of ORAUT-OTIB-0026, Revision 00 PC-2, which does not include an adjustment for work as a CTW. NIOSH prorated the table values to reflect a fractional year of employment. For the [REDACTED] of the [REDACTED], the calculated electron doses were multiplied by 0.855, which represents the midpoint of the uranium attenuation factors reported for two pairs of coveralls, including the paper liner (0.80) and one Dacron/cotton lab coat (0.91). NIOSH states in the DR report that while “this factor does not apply specifically to a glove worn on the hand, the records indicated that he wore a thin glove during assembly of parts and also that he performed meticulous work and did not list gloves as protective clothing worn.”

SC&A could only locate a single K-25 workbook in the EE’s files that was used to calculate the single year of coworker dose at K-25. As part of this Subtask 4 review, SC&A verified that the calculated dose was properly assigned in the Interactive RadioEpidemiological Program (IREP) input documents for both [REDACTED] cancers.

Finding 7: CTW Correction Not Applied

In the CATI report, the EE reports working as a “[REDACTED] and Maintenance [REDACTED].” Attachment A to OCAS-PER-014, which like PER-011 is related to ORAUT-OTIB-0052, identified both “[REDACTED]” and “maintenance” as career descriptions of CTWs. Although PER-11 does not go into the same level of detail, SC&A believes that this list is equally applicable for identifying CTW jobs at K-25. Based on this logic, SC&A believes this EE qualifies as a CTW and thus should receive the larger CTW coworker gamma dose. Using Table 3 from ORAUT-OTIB-0026, Revision 00 PC-2, and the parameters specified above, SC&A calculated a CTW coworker [REDACTED] dose of 1.134 rem from 30–250 keV photons (0.120 rem larger than the NIOSH assigned coworker dose.)

SC&A acknowledges that until early 2014, NIOSH incorrectly excluded CTWs working for the prime contractor from receiving CWT adjustments. This exclusion was and remains inconsistent with the current ORAUT-OTIB-0052 guidance. NIOSH has committed to addressing this issue in the form of a PER. SC&A suspects CTW adjustments were incorrectly omitted from the DR because the EE worked for prime contractors; however, SC&A could not find evidence supporting the company that employed the EE.

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Observation 2

SC&A questions the use of a beta dose attenuation factor of 0.855 that was used to modify coworker dose. Although it is consistent with ORAUT-OTIB-0017, *Interpretation of Dosimetry Data for Assignment of Shallow Dose*, Revision 01, guidance for when the specific level of protection is unknown, SC&A questions if the assignment is claimant favorable. ORAUT-OTIB-0017 directs that more information can be found in DOE Standard DOE-STD-1136-2000, *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities*. This reference has three types of gloves listed with associated beta reduction fractions. All three glove types have less beta attenuation than the assumed value. Additionally, the EE's reference to meticulous work in gloves was in reference to employment at Y-12, not K-25. In an instance where it is unclear what gloves, if any, the EE wore, it would be more appropriate to assign no attenuation factor. The assumption that gloves were worn reduced the beta coworker dose assigned by approximately 0.122 rem.

SC&A notes that, because Case [REDACTED] was compensated; resolution of Finding 7 and Observation 2 will not affect the compensation decision for this case.

6.0 BACKGROUND INFORMATION FOR CASE ██████████

Case ██████████ represents an EE who worked at the Oak Ridge Sites K-25, Y-12, and X-10 during ██████████ intermittent employment periods between ██████████ 1953, and ██████████ 1989. Records indicate the EE worked as an **electrician** during all ██████████ employment periods. The EE was diagnosed with ██████████ (ICD-9 Code ██████████) in June 1992.

6.1 COMPARISON OF NIOSH'S ORIGINAL AND REWORKED DOSE RECONSTRUCTIONS

NIOSH performed the original DR of Case ██████████ in February 2006. The claim was reworked in March 2010 to reevaluate this case in accordance with updated guidance that included coworker guidance. Both the original and revised DRs stated that the EE's radiation dose was overestimated using claimant-favorable assumptions. In the original DR, NIOSH calculated a ██████████ dose of 20.424 rem. Based on this assigned dose estimate, DOL determined the POC to be 22.11%, and the claim was denied.

Using the most current technical guidance documents and considering the revised coworker dose methodology, NIOSH recalculated the dose to the ██████████ in the revised DR. Table 6-1 compares the original and revised external and internal organ dose estimates for the ██████████. It should be noted that the values cited in Table 6-1 were extracted directly from NIOSH's reworked DR. With the exception of external coworker dose, SC&A has not assessed the accuracy and correctness of these doses, because performing such an assessment is beyond the scope of this Subtask 4 report.

Table 6-1. Comparison of NIOSH-Derived Dose Estimates Assigned in the Original and Reworked DRs

Dose Categories	Previous ██████████ Dose (rem)	Revised ██████████ Dose (rem)
External Measured and Missed	0.572	0.155
External Coworker	6.583	19.241
Medical X-ray	2.073	0.334
Internal	11.196	7.115
Total (rem)	20.424	26.845

Using the EE's DOE records and claimant-favorable assumptions, a ██████████ dose of 26.845 rem resulted in a POC of 32.58%. On this basis, the revised claim was **denied**.

6.2 SC&A'S REVIEW OF OCAS-PER-011 ISSUES RELATED TO THIS CASE

As directed by the Subcommittee on Procedures Review, SC&A's review of Case ██████████ strictly focused on external coworker models. Case ██████████ was included in the pool of claims that required the DR to be reworked because it met the PER-011 criteria that (1) the original DR was performed between May 31, 2005, and August 31, 2006, (2) coworker dose was assigned, (3) the EE qualified as a CTW, and (4) the POC was less than 50%.

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In the **original** DR, NIOSH identified that the EE was potentially exposed to external photons from [REDACTED] 1951, through 1979 but was unmonitored for external exposure. A best estimate of the [REDACTED] organ dose was assigned using the lognormally distributed annual photon doses at Y-12 from ORAUT-OTIB-0013, *Technical Information Bulletin: Individual Dose Adjustment Procedure for Y-12 Dose Reconstruction*, Revision 00, using Monte Carlo techniques in accordance with OCAS-IG-001, *External Dose Reconstruction Implementation Guideline*. Coworker dose from X-10 and K-25 was not assessed because the EE “was monitored for external dose at Y-12 after 1979,” according to the DRR. This resulted in a total [REDACTED] coworker dose assigned of 6.583 rem.

In the **reworked** DR, NIOSH identified that the EE was unmonitored from 1951 through 1958, and from 1967 through 1979. NIOSH assumed the EE was exposed to the 50th percentile gamma CTW coworker dose. Because the EE worked between the three Oak Ridge Sites, NIOSH compared the 50th percentile annual coworker doses at the facilities for each year and assigned the highest annual value to the EE for each year. SC&A could not locate specific guidance on how to treat coworker dose in employment scenarios like the EE’s; however, the method used is logical and claimant favorable.

K-25 coworker values were obtained from Table 3 of ORAUT-OTIB-0026, Revision 00 PC-2. Values representing Y-12 and X-10 CTW coworker doses were extracted from Table 7-2 of ORAUT-OTIB-0064, *Coworker External Dosimetry Data for the Y-12 National Security Complex*, Revision 01, and Table 3 of ORAUT-OTIB-0021, *Coworker External Dosimetry Data for the K-25 Site*, Revision 01, respectively. SC&A previously assessed CTW coworker dose at X-10 and Y-12 during its evaluation of OCAS- PER-014; further evaluation is outside the scope of this review. NIOSH found that from 1967 through 1974, K-25 50th percentile CTW coworker dose was most claimant favorable. The remaining years of coworker dose assigned by NIOSH are summarized in Table 6-2.

Table 6-2. Summary of Coworker Model Applied to Each Year

Coworker Year	Model Used
1951	Y-12 50th percentile CTW
1952	Y-12 50th percentile CTW
1953	Y-12 50th percentile CTW
1954	Y-12 50th percentile CTW
1955	X-10 50th percentile CTW
1958	Y-12 50th percentile CTW
1967	K-25 50th percentile CTW
1968	K-25 50th percentile CTW
1969	K-25 50th percentile CTW
1970	K-25 50th percentile CTW
1971	K-25 50th percentile CTW
1972	K-25 50th percentile CTW
1973	K-25 50th percentile CTW
1974	K-25 50th percentile CTW
1975	X-10 50th percentile CTW
1976	X-10 50th percentile CTW
1977	X-10 50th percentile CTW
1978	X-10 50th percentile CTW
1979	X-10 50th percentile CTW

NIOSH assumed the EE was likely exposed to 100% 30–250 keV photons and assumed a DCF equal to 1.244 for the [REDACTED]. This resulted in the total coworker photon dose of 19.241 rem to the [REDACTED].

NIOSH used the case-specific workbook to model coworker dose for this claimant. As part of this Subtask 4 review, SC&A verified that the calculated dose was properly assigned in the IREP input documents for the [REDACTED] cancer. SC&A’s review of OCAS-PER-011 did not find any issues related to the reconstruction of coworker dose for Case [REDACTED].

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7.0 SUMMARY CONCLUSIONS

Under SCA-TR-PR2009-0002, *A Protocol to Review NIOSH's Program Evaluation Reports (PERs)*, Revision 1 (SC&A 2009), Subtask 4 requires the audit of DR cases reworked as a result of the PER under review. Based on guidance in OCAS-PER-011, cases required rework if they met the following criteria:

- Claims that were completed prior to May 21, 2005, and determined to have been completed using external coworker data
- Claims completed between May 21, 2005, and August 31, 2006, that used external coworker data and were deemed CTWs

Therefore, in order to satisfy Subtask 4, SC&A recommended in SCA-TR-PR2013-0080 (SC&A 2013) the selection of two cases from the following modified categories:

- Claims originally completed before May 31, 2005, using an external coworker model and revised as a result of PER-011
- CTW claims that were originally completed between May 21, 2005, and August 31, 2006, using external coworker data and revised as a result of PER-011

Cases [REDACTED] and [REDACTED] were assigned to SC&A because they meet the first category. Cases [REDACTED] and [REDACTED] were assigned to SC&A because they meet the second category. Each case's coworker dose reconstruction was reviewed.

For each of the four reviewed cases, SC&A provided an overview of the case and a brief comparison of external and internal doses assigned in the original and revised DRs. Based on directives from the Subcommittee on Procedures Review, SC&A's audit of these cases focused strictly on those elements of the DR that were affected by the issuance of OCAS-PER-011.

SC&A's Subtask 4 review resulted in the identification of two findings. Because this Subtask 4 evaluation is a continuation of the review of PER-011 documented in SCA-TR-PR2013-0080 (SC&A 2013), and that review identified five findings, the finding numbers in this review begin at 6. These findings are summarized below.

- **Finding 6 – No CTW adjustment is made for employment as a [REDACTED] laborer.**
- **Finding 7 – No CTW adjustment is made for employment as a [REDACTED] and maintenance [REDACTED].**

Both findings highlight the concern SC&A expressed in its initial review of PER-011 relating to the proper identification of CTWs. Critical to processing each claim correctly is the proper identification of a CTW, which, as it stands, is a subjective term. SC&A remains concerned that without clearly defined criteria to identify CTWs, identical claims could potentially be processed as both CTW and non-CTW by different reviewers. SC&A acknowledges that a degree of professional judgment will always be required by DRs; however, clearly defined criteria such as

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those used by OCAS-PER-014 are the only way to ensure claims are identified and handled consistently.

SC&A notes that as a result of the initial SC&A review of PER-011 (SC&A 2013), it was determined that NIOSH was incorrectly excluding CTWs employed by the prime contractor from receiving CWT adjustments. This exclusion was and remains inconsistent with the current ORAUT-OTIB-0052 guidance, and NIOSH has committed to addressing this issue in the form of a PER. SC&A suspects CTW adjustments may have been omitted in both cases because NIOSH determined the EE worked for a prime contractor. In any case, NIOSH needs to confirm that the cases will be covered under the PER to correct this error.

In Sections 3 through 6 above, SC&A also made two observations. In the first observation, SC&A notes that the case files appear to contradict the EE's job category. NIOSH did not apply a CTW correction, but it was unclear to SC&A if a CTW correction should have been applied. In the second observation, SC&A points out that the use of a beta dose attenuation factor may result in a not-claimant-favorable underestimate of the coworker dose received by the EE.

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