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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SPR-approved documents

- DCAS-PER-045, rev. 0, “Aliquippa Forge TBD Revision”
- DCAS-PER-076, rev. 0, “Aliquippa Forge TBD”
- DCAS-PER-077, rev. 0, “Simonds Saw and Steel TBD”
- DCAS-PER-043, rev. 0, “Internal Dosimetry Organ, External Dosimetry Organ, and IREP Model Selection by ICD-9 Code Revision”
- DCAS-PER-059, rev. 0, “Norton Company”

DCAS-PER-045

- Title: “Aliquippa Forge TBD Revision”
- Issued April 2012 due to revisions to Aliquippa Forge site profile (ORAUT-TKBS-0021)
- Revision resulted from identification of new data and incorporating data from revision 01 of ORAUT-OTIB-0070, “Dose Reconstruction During Residual Radioactivity Periods at Atomic Weapons Employer Facilities”
  - increased external dose during most of the residual period
  - decreased internal dose for most years but increased for some

Aliquippa Forge Facility operational history

- Produced uranium rods from uranium billet
- Rolling operation started in January 1947 through the Atomic Energy Commission (AEC) contract period ending on February 28, 1950
- Residual period was from March 1, 1950, through December 31, 1987, and again from January 1, 1989, through December 31, 1992

SC&A's review of PER-045

- Review submitted August 20, 2014
- Review identified 8 findings and 2 observations
- All findings and observations were discussed and closed at the Subcommittee for Procedure Reviews (SPR) meeting on May 16, 2016

Subtask 1 review of PER-045

- Subtask 1: Assess NIOSH's evaluation of the issues prompting PERs and their potential impact on dose reconstruction (DR).
- SC&A identified two observations:
  - **Observation 1:** NIOSH should rephrase the role of ORAUT-OTIB-0070 in section 2.0 of DCAS-PER-045.
  - **Observation 2:** Neither rev. 00 nor rev. 01 of the Aliquippa Forge TBD (ORAUT-TKBS-0021) was ever reviewed or audited by SC&A.

Subtask 2 review of PER-045

- Subtask 2: Assess NIOSH's specific methods for corrective action
- SC&A previously reviewed OTIB-0070
- SC&A performed a focused review of Aliquippa Forge TBD, rev. 01, pertaining to residual period doses
- SC&A identified 7 findings:
  - **Finding 1:** Failure to account for a previous decontamination and decommissioning effort
  - **Finding 2:** Backward extrapolation by means of the NIOSH-derived source term depletion factor is inappropriate
  - **Finding 3:** SC&A was unable to match inhalation and ingestion rates in table 3
  - **Finding 4:** Failure to acknowledge and use a reported air sample that at 180 dpm/m^3 was ~20-fold higher than NIOSH's value of 8.94 dpm/m^3

Subtask 2 review of PER-045, findings 5–7

- **Finding 5:** NIOSH's "conversion" of empirically measured air concentration 8.94 dpm/m^3 that was reduced more than 42-fold to a "modeled air concentration" represents a major error as the starting point for deriving inhalation and ingestion doses for years 1950 to 1995.
- **Finding 6:** Inappropriate use of the resuspension factor 1×10^{-6} m^{-1} for post-AEC work during active operations at the Aliquippa Forge facility.
- **Finding 7:** Use of 1992 survey measurement (350 dpm/100 cm^2) removable alpha contamination postdates the "interim decontamination efforts" conducted from October to December 1988.

Subtask 3 review of PER-045

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- SC&A had one finding
- **Finding 8:** NIOSH's methodology for deriving inhalation and ingestion doses does not comply with the use of available data and the prioritization of recommended methods defined in ORAUT-OTIB-0070, rev. 01

Issue resolution for PER-045 findings 1–8

Finding date	Finding description	NIOSH response	Finding resolution
8/20/2014	Findings 1–8 as described in previous slides. **3/24/2015.** SC&A submitted its review of NIOSH's response to the PER-045 findings. In summary, NIOSH agreed with finding 5, which involved incorrectly deriving air concentration for 1950. All other findings were tied to the faulty assumptions used to reconstruct that air concentration.	**1/23/2015.** NIOSH provided a response to the 8 findings.	**5/16/2016.** SPR closed all findings.

Subtask 4 review of PER-045

- ABRWH selected one reworked case for SC&A's review April 2021, based on following criteria:
  - assignment of external dose during the residual period
  - assignment of internal dose during the residual period
- SC&A reviewed reworked case in December 2021 to determine if external and internal doses were correctly assessed in accordance with PER-045

NIOSH reworked DR for PER-045

- NIOSH's rework of the case:
  - Used applicable DR tools
  - Recalculated all annual doses
  - Re-ran IREP
- Revised DR report not sent to DOL because the compensation decision did not change

PER-045 case background

- Energy employee (EE) worked at Aliquippa Forge for two brief timeframes during the residual period
- EE worked throughout site
- EE was not monitored for radiation exposure
- Diagnosed with qualifying cancers more than two decades after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-045 case

Dose categories	Reworked vs. original dose percentage
External	~ 207% increase
Occupational medical	No change
Internal	~ 80% decrease
Total	~ 39% decrease
POC	~ 158% decrease

Original external dose calculations for PER-045 case

- Used external exposure values from table 13 of ORAUT-TKBS-0021, rev. 00 PC-1
- Doses prorated for partial years of employment
- Dose conversion factors (DCFs):
  - DR report stated DCF values based on thyroid (1.440) as the surrogate organ
  - Doses actually calculated using the maximum thymus DCF values (1.692)
  - This resulted in a slight overestimate of dose
- Assigned dose to all cancer sites ~0.300 rem

Reworked external dose calculations for PER-045 case

- Used external exposure values from table 5-1 of TBD rev. 01
- No prorating for partial years of employment
- Applied exposure DCF of 1.44 for the thyroid as the surrogate organ
- Assigned dose of ~1.100 rem to all cancer sites

SC&A's conclusions on external dose for PER-045 case

- Appropriate dose values selected from table 5-1 of TBD rev. 01
- Correct surrogate organ was selected, based on ORAUT-OTIB-0005, rev. 05
- Appropriate DCF value was applied
- No partial year prorating applied, as an efficiency and claimant-favorable measure
- Review confirmed doses were accurately entered in IREP
- As expected, reworked DR external dose increased from that calculated in the original DR
- SC&A had no findings about reworked external dose assignment

Comparison of internal dose calculations for PER-045 case

Original DR

- Used inhalation and ingestion intakes from table 13 of TBD rev. 00 PC-1
- Used IMBA to compare doses from uranium absorption types M and S, with type S resulting in the higher dose
- Assigned dose of ~2.200 rem to all cancer sites

Reworked DR

- Used inhalation and ingestion exposure values from table 5-1 of TBD rev. 01
- Compared solubility types M and S, with type S resulting in higher dose
- Using CADW, calculated dose of ~0.400 rem to all cancer sites

SC&A's conclusions on internal dose for PER-045 case

- Reviewed NIOSH's CADW files for the reworked DR and confirmed that correct intake values were used, based on data in table 5-1 of TBD rev. 01
- SC&A verified:
  - Type S solubility resulted in the higher dose
  - Dose data appropriately entered in IREP table
  - Doses were assessed to the date of cancer diagnoses
- SC&A had no findings about the assessment of internal dose in the reworked case

Board discussion of DCAS-PER-045

DCAS-PER-076, rev. 0

- Title: “Aliquippa Forge TBD”
- Issued February 15, 2017
- Resolution of PER-045 findings/observations resulted in the issuance of rev. 02 of Aliquippa Forge TBD on November 16, 2015, prompting PER-076
- Revision resulted in an increase in external and internal doses during the residual period (1950–1995)
- Since SC&A reviewed prior TBDs, SPR determined only subtask 4 review was necessary

PER-076 subtask 4 review

- Subtask 4: Conduct audits of a sample set of DRs affected by PER
- NIOSH reevaluated 21 cases:
  - One case resulted in a POC >52%
  - Remaining cases resulted in a POC <45%
- SC&A recommended selecting cases based on the criteria:
  - Assignment of external dose during the residual period
  - Assignment of internal dose during the residual period

PER-076 subtask 4 case review process

- SC&A submitted its subtask 4 review of PER-076 on April 18, 2018
- SC&A presented its review to the SPR at the February 13, 2019, meeting
- One case was reviewed in which the EE was assigned external and internal dose during the residual period
- SC&A had no findings

PER-076 case background

- EE worked at Aliquippa Forge for two timeframes during the residual period
- EE worked primarily in one building at the site
- No records of external or internal monitoring available
- Diagnosed with a qualifying cancer several decades after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-076 case

Dose categories	Reworked vs. original dose percentage
External	548% increase
Internal	325% increase
Total	547% increase
POC	452% increase

Original external dose for PER-076 case

- DR performed in 2008
- External doses based on values in table 13 of ORAUT-TKBS-0021, rev. 00 PC-1
- Applied applicable OCAS-IG-001 DCF
- Total external dose <1.0 rem
- Annual doses entered in IREP as lognormal distribution with geometric standard deviation (GSD) of 1.5

Reworked external dose for PER-076 case

- DR performed in 2016
- External doses based on annual values in table 5-1 of ORAUT-TKBS-0021, rev. 02
- Applied applicable IG-001 DCF
- Total external dose >4.0 rem
- Significant increase in external dose reflects the use of a revised starting air concentration value, which increased by a factor of 42 between rev. 01 and rev. 02 of the TBD
- Annual doses entered in IREP as constant values

Original internal dose for PER-076 case

- Used Aliquippa Forge TBD, rev. 00 PC-1, table 13:
  - inhalation intakes of 3.40 pCi/d
  - ingestion intakes of 0.071 pCi/d during the residual period
- Used IMBA to compare solubility types M and S, with type M resulting in higher dose
- Total dose <0.010 rem
- Annual doses entered in IREP as lognormal distributions with GSD of 3

Reworked internal dose for PER-076 case

- Used Aliquippa Forge TBD, rev. 02, table 5-1, revised annual inhalation and ingestion intakes
- Inhalation values entered in CADW as type M solubility absorption
- Ingestion values entered as f(1) max, which assesses all absorption types and assigns the highest dose for the selected organ
- Total dose <0.100 rem
- Annual doses entered in IREP as constant values

SC&A's conclusions about external and internal dose calculations for PER-076 case

- External dose:
  - Verified correct doses were used from table 5-1 of TBD rev. 02
  - Confirmed appropriate anterior-posterior (AP) DCF from IG-001 was applied
  - SC&A was able to reproduce NIOSH's doses
  - Annual doses entered in IREP as specified in TBD rev. 02
- Internal dose:
  - Verified annual inhalation and ingestion intakes from table 5-1 of TBD rev. 02 correctly entered in CADW
  - Confirmed that solubility type M provided greater overall dose
  - Confirmed dose values appropriately entered in IREP with a constant distribution
- SC&A had no findings about the rework of PER-076 case

Board discussion of DCAS-PER-076

DCAS-PER-077, rev. 0

- Title: “Simonds Saw and Steel TBD”
- PER issued February 28, 2017
- Determines the impact of rev. 02 changes to the Simonds Saw and Steel TBD
- Key TBD revisions:
  - Updated operational period external dose and internal intake rates for operational workers to assign the 95th percentile and 50th percentile to administrative workers
  - Updated residual period external dose and internal intake rate assignments and increased exposure time from 2,000 to 2,500 hours per year
- Since SC&A reviewed prior TBDs and the PER reevaluated all cases with POCs <50%, SPR determined only subtask 4 review was necessary

Simonds Saw and Steel operational history

- Involved in rolling natural uranium and some depleted and enriched uranium and thorium rods
- Rolling operation February 24, 1948, through December 31, 1957
- Residual period January 1, 1958, through the present

PER-077 subtask 4 review

- Subtask 4: Conduct audits of a sample set of DRs affected by PER
- NIOSH evaluated 105 cases:
  - 27 cases resulted in a POC >50%
  - 78 cases resulted in a POC <45%
- SC&A recommended selecting cases based on 3 criteria:
  1. Operations/production worker employed during some portion of operational and residual periods who was not monitored internally and either partially or not monitored externally
  2. Administrative/office worker who was employed during the operational period
  3. At least one case with covered employment during the entire year of 1948

PER-077 subtask 4 case review process

- SC&A submitted its subtask 4 review of PER-077 on June 11, 2018
- SC&A presented its review to the SPR at the February 13, 2019, meeting
- One case was selected that met criteria 1 and 3 for an operational/production worker
- No cases were available for an EE with a job category of administrative/office worker

PER-077 case background

- EE worked at Simonds Saw and Steel for nearly 3 decades
- EE was an operator for a specific trade
- EE was diagnosed with a qualifying cancer after termination of employment

Comparison of NIOSH's reworked doses and original doses for PER-077 case

Dose categories	Reworked vs. original dose percentage
External	545% increase
Internal	53% increase
Total	506% increase
POC	57% increase

Original external dose assumptions for PER-077 case

- DR performed in 2005
- EE was not monitored for external exposure
- NIOSH used TBD rev. 00 PC-1 median values and associated GSDs from table 18 (operational period) and table 20 (residual period)
- Dose assessed for four exposure scenarios:
  - ambient contamination submersion during operations
  - uranium billets during operational rolling
  - uranium rods during operational rolling
  - post-operational residual contamination
- Applied applicable IG-001 maximum exposure-to-organ DCFs:
  - Assumed isotropic (ISO) geometry for submersion in ambient contamination
  - Assumed AP geometry for operational rolling and residual contamination
- NIOSH calculated a total external dose of >10 rem

Reworked external dose for PER-077 case

- Reevaluated DR performed 2017
- Assumed EE was an operations/production worker during the operational period
- Assigned the 95th percentile annual doses in table 4-3 of TBD rev. 02
- Annual residual dose was assessed using the value of 200 mrem per year from table 5-3 of TBD rev. 02
- Total external dose of >69 rem assigned

Notable differences between reworked and original external dose calculations

Original 2005 DR

- Used median dose rates with associated GSDs during operational period
- Assumed 2,000 hours exposure at 80 mR/hr, input as GSD of 3.5 during residual period
- Assumed ISO geometry for submersion dose during the operational period
- Used maximum AP exposure-to-organ dose DCFs
- Calculated dose for full termination year

Reworked 2017 DR

- Used 95th percentile dose rates input as constants during operational period
- Assumed 2,500 hours of exposure at 80 mR/hr, input as a constant during residual period
- Assumed AP geometry for all 4 exposure scenarios
- Used midpoint value of AP exposure-to-organ dose DCF
- Prorated dose for partial year of termination employment

SC&A's conclusions about external dose for PER-077 case

- Confirmed that NIOSH used correct external exposure rates based on TBD rev. 02
- Determined that appropriate guidance from TBD rev. 02 was followed
- Verified doses were input in IREP correctly
- SC&A has no findings or observations related to calculation of external dose

Original internal dose for PER-077 case

- EE was not monitored for internal exposure
- NIOSH used TBD rev. 00 PC-1 intake values, absorption types, and associated GSDs from:
  - Table 15 for the operational period
  - Table 20 for the residual period
- Internal exposure to uranium via inhalation intakes assigned for each year of covered employment with no prorating for termination year
- Inhalation exposure to recycled uranium (RU) contaminants (neptunium and plutonium) was assumed during operational period
- Since source term relied on air sampling measurements rather than bioassay, inhalation and ingestion intakes of Th-232 and Th-228 were assessed
- Total internal dose of ~0.500 rem assigned

Reworked internal dose for PER-077 case

- NIOSH used TBD rev. 02 intake values, absorption types, and associated GSDs from table 3-13 (operational period) and table 5-1 (residual period)
- EE was considered an operations/production worker; therefore, 95th percentile intake values were used
- Dose for termination year was prorated
- Inhalation exposure to RU contaminants was expanded to include Tc-99 as well as Np-237 and Pu-239 and was assumed during operational period
- Due to SEC, thorium exposure only assessed for residual period
- Thorium daughter products included Th-232,Th-228, Ac-228, Ra-228, and Ra-224
- Total internal dose of ~0.800 rem assigned

SC&A's conclusions about internal dose for PER-077 case

- Using the TBD rev. 02 intake rates from table 3-13 (operational period) and table 5-1 (residual period), SC&A was able to recreate the assigned internal doses to within 2% of NIOSH's internal dose calculation
- SC&A had no findings or observations about NIOSH's reworked internal dose

Board discussion of DCAS-PER-077

DCAS-PER-043, rev. 0

- Title: “Internal Dosimetry Organ, External Dosimetry Organ, and IREP Model Selection by ICD-9 Code Revision,” which is ORAUT-OTIB-0005
- PER issued June 7, 2013
- OTIB-0005 was initially issued March 11, 2003
- NIOSH issued nine revisions of OTIB-0005 prior to issuing PER-043

OTIB-0005 revisions that may increase organ dose and required DCAS-PER-043

- Revision 01 PC-1 added bone cancer model as possible option to International Classification of Diseases Ninth Edition (ICD-9) code 238.7.
- Revision 01 PC-2 changed designated internal organ for ICD codes 231.8, 235.8, and 235.9 from lung to “medical review,” and external organ for prostate was changed from testes to bladder.
- Revision 02 modified adenocarcinoma of the lower third of the esophagus and required modeling of esophagus and stomach to determine which is higher.
- Revision 03 changed the internal organ for ICD-9 code 155.1 from gallbladder to liver/gallbladder.
- Revision 04 changed target organs for ICD-9 codes 238.0 and 239.2. Internal target organ changed from “medical review” to bone surfaces, and external target organ changed from red bone marrow to bone surface.
- Revision 05 added code 204.1 for chronic lymphocytic leukemia.

SC&A's review of PER-043, rev. 0

- Subtask 1–3 review submitted August 18, 2014
  - SC&A identified 0 findings
- Subtask 1–3 review presented to the SPR at the August 28, 2014 meeting
- Subtask 4 review submitted December 17, 2014
  - SC&A identified 3 findings
- All findings from subtask 4 review were discussed and closed at the SPR meeting on February 18, 2015

Subtask 1 review of DCAS-PER-043, rev. 0

- Subtask 1: Assess NIOSH's evaluation of the issues prompting PERs and their potential impact on DR
- To assess subtask 1, SC&A reviewed OTIB-0005, rev. 05, which states:
  - Section 2.0: "organs or tissues for which doses must be estimated are those that are delineated by the specified ICD-9 code that is received from the U.S. Department of Labor (DOL)."
  - Section 2.0: "Coding of the cancers is conducted by DOL on the basis of ICD-9."
  - Section 4.2: "Due to the complexity of determining the appropriate organs and tissues for some ICD-9 code cancers, a medical review by an Oak Ridge Associated Universities (ORAU) Team physician is required to determine the organs and tissues to use in IMBA for those cancers."

SC&A's subtask 1 conclusion for PER-043

- Revisions to OTIB-0005 were exclusively introduced by parties generally not within the scope of SC&A's review
- SC&A assumes that changes and additions to ICD-9 codes reflect updates/revisions to the International Classification of Diseases and ORAUT's improved understanding of corresponding internal and external target organs
- SC&A accepts the changes and had no findings or observations for subtask 1

Subtask 2 review of DCAS-PER-043

- Subtask 2: Assess NIOSH's specific methods for corrective action
- SC&A subtask 2 assessment:
  - Reviewed all revisions stated in PER-043
  - Compared these to statements in the text and to entries in table 3-1 of OTIB-0005, rev. 05
- SC&A had no findings or observations under subtask 2

Subtask 3 review of DCAS-PER-043

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH's criteria to determine population of claims potentially affected by DCAS-PER-043 included:
  - Cases completed before the issue date of a specific revision, which had the potential of increasing the dose
  - Cases with a derived POC less than 50%
  - Cases that met one or more changes that were identified in PER-043
- NIOSH identified 36 previously completed cases:
  - 2 cases resulted in a revised POC greater than 50%
  - 34 claims resulted in POCs less than 45%

Subtask 3 assessment of PER-043

- SC&A was not given access to primary data used to identify and quantify those cases that qualified for reevaluation; therefore, was not able to verify 36 cases
- SC&A's evaluation limited to methodology/criteria employed to identify cases that were potentially impacted by PER-043
- SC&A concluded that screening criteria used to identify potentially impacted claims are scientifically sound
- SC&A had no findings under subtask 3

Subtask 4 case selection criteria for PER-043

1. **Revision 02 of OTIB-0005: ICD-9 code 150** – Change required the need to consider stomach cancer (both target organ and cancer model) for esophageal cancer of the lower third portion of the esophagus. Select one case from among four affected cases with reworked POC of <50%.
2. **Revision 03: ICD-9 code 155.1** – Change specified liver as the appropriate internal dose organ for cases that had previously used the gallbladder. Select one case from 15 affected claims with reworked POCs of <50%.
3. **Revision 04: ICD-9 code 232** – Added basal carcinoma to the considered cancer models for code 232 when cell type was not specified. Select one claim from 16 reworked claims with POC of <50%.
4. **ICD-9 code 238** – changed target organs. Select the single claim that was reevaluated and resulted in a POC of <50%.

Subtask 4 case review of DCAS-PER-043

- Subtask 4: Conduct audits of a sample set of DRs affected by PER
- Based on selection criteria, NIOSH identified 4 cases for SC&A's review
- SC&A's review resulted in the following:
  - Case A: Two findings on the assignment of an incorrect ICD-9 code to a metastatic cancer
  - Case B: No findings
  - Case C: One finding on NIOSH's selection of the internal organ that required a medical review
  - Case D: No findings

PER-043 case A background

- EE worked at a DOE covered facility for more than 2 decades
- EE was initially diagnosed with a cancer that was not discussed in PER-043 (original DR)
- A second cancer with assigned ICD-9 code 238.0 was diagnosed shortly after termination of employment (DR rev. 1)
- OTIB-0005, rev. 04, changed internal target organ for ICD-9 code from “medical review” to bone surface (DR reworked under PER)

Comparison of NIOSH's reworked doses and original doses for PER-043 case A

Dose categories	Dose reworked under PER vs. DR rev. 1 dose percentage for cancer 2
External	~19% increase
Occupational medical	~54% increase
Internal	~838% increase
Total	~489% increase
POC	~330% increase (when combined with cancer 1)

SC&A's review of PER-043 case A

- SC&A concluded that the second cancer should not have been assigned ICD-9 code 238.0 but should have been considered a metastatic cancer and assigned the same ICD-9 code as the primary cancer
- This conclusion resulted in two findings

Issue resolution for PER-043 case A finding 1

Finding date	Finding description	NIOSH response	Finding resolution
12/17/2014	Failure to revise ICD-9 code 238.0 to that of the primary cancer, code 209.35. Had the ICD-9 code for the "metastatic" cancer been changed to 209.35, case A would not have required reevaluation under the stated criteria of DCAS-PER-043.	**4/28/2015.** NIOSH agreed. However, after lengthy discussions, it was determined the error was committed by DOL, did not impact the POC for the case, and does not appear to be systemic. Therefore, no additional remediation necessary.	**4/28/2015.** SPR closed the finding.

Issue resolution for PER-043 case A finding 2

Finding date	Finding description	NIOSH response	Finding resolution
12/17/2014	As a metastatic cancer for which the primary cancer was identified, there was neither a need to assess the dose to the metastatic cancer (since it is essentially identical to that of the primary cancer), nor include such a dose for the calculation of the POC.	**4/28/2015.** NIOSH agreed. However, after lengthy discussions, it was determined the error was committed by DOL, did not impact the POC for the case, and does not appear to be systemic. Therefore, no additional remediation necessary.	**4/28/2015.** SPR closed the finding.

PER-043 case B background

- EE worked at a DOE covered facility for 2 time periods
- EE was diagnosed with a cancer that was assigned ICD-9 code 150.5
- The original DR calculated doses from external, medical, and internal exposures to the distal **esophageal tissue**
- Under rev. 02 of OTIB-0005, NIOSH recalculated dose using the **stomach** as the internal and external organ
- SC&A's review did not identify any findings or observations

Comparison of NIOSH's reworked doses versus original doses for PER-043 case B

Dose categories	Rework vs. original dose percentage
External	~40% decrease
Occupational medical	~23% decrease
Internal	~378% increase
Total	~0.03% decrease
POC	~9% decrease

Differences between original and reworked external dose calculations for PER-043 case B

Original DR

- Uses esophagus as the external organ of interest
- External Dosimetry Data Workbook used
- Applied dose from <30 keV to account for exposure to plutonium
- Total dose assigned of nearly 3.0 rem

Reworked DR

- Uses stomach of external organ of interest
- Updated External Dosimetry Data Workbook used
- Assigns all dose as 30–250 keV (unlikely EE worked in plutonium area)
- Total dose assigned <2.0 rem

Differences between original and reworked internal dose calculations for PER-043 case B

Original DR

- Uses the esophagus as the internal organ of interest
- Environmental internal dose calculated using CADW
- Total internal dose assigned of <0.5 rem

Reworked DR

- Uses the stomach as the internal organ of interest
- OTIB-0018 applied to ensure an overestimate of internal dose
- Total internal dose assigned of >1.5 rem

SC&A's conclusions about external and internal doses for PER-043 case B

- SC&A reviewed and compared derived external and internal dose estimates calculated in the original DR to reassess external and internal dose
- SC&A concurs with the elimination of external exposures to <30 keV photons from plutonium based on case job title information
- Revised internal dose likely overestimated since based on ORAUT-OTIB-0018
- SC&A had no findings or observations about NIOSH's reworked internal dose

PER-043 case C background

- EE worked at a DOE covered facility
- EE employment spanned a few years
- Diagnosed with cancer assigned ICD code 155.1 after employment termination
- OTIB-0005, rev. 03, changed organs used for ICD code 155.1:
  - The external organ was changed from bladder to liver
  - The internal organ was changed from gallbladder to liver/gallbladder

Comparison of NIOSH's reworked doses and original doses for PER-043 case C

Dose categories	Rework vs. original dose percentage
External	Same
Occupational medical	Same
Internal	~1,653% increase
Total	~142% increase
POC	~49% increase

Comparison of original and reworked external dose calculations for PER-043 case C

Original DR

- Uses bladder as the external organ of interest
- Applied DCF of 1 for all energy ranges, which was claimant favorable
- Total dose assigned of >3.0 rem

Reworked DR

- Uses liver of external organ of interest
- Dose not changed, since original used claimant-favorable DCF
- Same total dose assigned

Comparison of original and reworked internal dose calculations for PER-043 case C

Original DR

- Uses the gallbladder as the internal organ of interest
- Total internal dose assigned of <0.5 rem

Reworked DR

- Uses the liver as the internal organ of interest
- Total internal dose assigned of >5 rem

SC&A's conclusions on PER-043 case C dose calculations

- NIOSH's choice of surrogate organ for EE's cancer is questionable, since there are three general locations where the cancer could arise.
- ORAUT-OTIB-0005, rev. 05, states that, "If the description is unclear, a medical review should be conducted to determine the appropriate internal organ of interest."
- EE's records did not indicate that a medical review was performed.
- Based on this information, SC&A identified finding 3.

Issue resolution for PER-043 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
12/17/2014	In the absence of a medical review that would specify the cancer as extrahepatic, NIOSH's selection of the liver as the appropriate internal organ is inappropriate and would obviate the need for Case C to be reevaluated.	**4/28/2015.** NIOSH stated that in the PER process, if you can do a DR with available information and determine that the POC is still below 50%, there is no need to stop the process and get a medical review.	**4/28/2015.** SPR agreed with NIOSH's response and closed the finding.

PER-043 case D background

- EE worked at an AWE covered facility for a brief employment period
- Diagnosed with a qualifying cancer identified with ICD-9 code 232.6
- Prior to rev. 04 of OTIB-0005, a comparison of **malignant melanoma** and **non-melanoma squamous cell carcinoma** was made and the one that produced the higher POC value was assigned. Revision 04 added **basal cell carcinoma** as a third option.

NIOSH rework of PER-043 case D

- Original DR calculated doses for malignant melanoma
- Rework recalculated doses assuming non-melanoma basal cell carcinoma
- Rework determined that malignant melanoma produced the higher dose and POC

SC&A's assessment of NIOSH's rework of PER-043 case D

- SC&A confirmed that NIOSH's rework assuming non-melanoma basal cell carcinoma produced a lower POC than malignant melanoma used in original DR
- SC&A could not determine if NIOSH performed a rework using non-melanoma squamous cell carcinoma
- SC&A independently assessed the non-melanoma skin squamous cell IREP model, which yielded the lowest POC value
- SC&A concurs with NIOSH that, for case D, the IREP model malignant melanoma yields the highest POC value
- SC&A had no findings or observations about NIOSH's rework of case D

Board discussion of DCAS-PER-043

DCAS-PER-059

- Title: “Norton Company”
- Issued April 2015 due to revisions to the Norton Company template
- Revision included:
  - Modified template to include second SEC class corresponding to a portion of residual period (January 1, 1958, to October 10, 1962)
  - Incorporated updated ORAUT-OTIB-0070, rev. 01, guidance, which adopted a lower depletion rate of 0.067% per day for residual contamination starting October 10, 1962, through 2009

Summary of Norton Facility operational history

- Worked with thorium and uranium
- Operational period 1945 through 1957
- Residual radiation period 1958 through October 2009
- No technical basis documents
- DR methodology incorporated into a template

SC&A's review of PER-059

- Subtask 1–3 review submitted May 22, 2017
  - SC&A identified 3 findings
- All subtask 1–3 findings were discussed and closed at the SPR meeting on October 31, 2018
- Subtask 4 review submitted December 28, 2021
  - SC&A identified 0 findings
- Subtask 4 review presented at the May 25, 2022, SPR meeting

Subtask 1 review of PER-059

- Subtask 1: Assess NIOSH's evaluation of the issues prompting PERs and their potential impact on DR
- SC&A regards (1) the addition of SEC-00173 class and (2) adoption of a reduced residual period depletion rate as justification for revising the Norton Company template and reevaluating worker doses as defined in PER-059
- SC&A has no findings or observations under subtask 1

Subtask 2 review of DCAS-PER-059

- Subtask 2: Assess NIOSH's specific methods for corrective action
- SC&A has reviewed the documents that prompted the issuance of PER-059:
  - August 29, 2008: SC&A issued its review of ORAUT-OTIB-0070
  - July 7, 2011: SC&A issued a focused review of the Norton Company SEC petition evaluation report (ER) for SEC-00173
- SC&A had not reviewed any versions of the Norton template. Therefore, its subtask 2 review included assessment of external and internal DR methodology
- SC&A identified 3 findings

Issue resolution for PER-059 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
5/22/2017	There is insufficient information in the Norton template for identifying critical data and parameters needed to (1) duplicate and (2) confirm NIOSH's model for estimating external deep and shallow doses starting in residual period of 1962. **10/31/2018.** SC&A confirmed that its 2011 focused review of the SEC ER evaluated and approved methodology.	**11/20/2017.** NIOSH stated that the methodology for estimating external doses was taken from the SEC ER, which was reviewed by SC&A.	**11/20/2017.** SPR requested that SC&A confirm that the ER was reviewed and the methodology approved. **10/31/2018.** SPR closed the finding.

Issue resolution for PER-059 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
5/22/2017	Five of the nine "air dust" survey references are considered "operational" thoria and uranium data with dates starting in 1958 through 1964. Operational survey data for thoria/uranium after 1957 are in contradiction with the template's designated "operational" period that ends in 1957.	**11/20/2017.** NIOSH agreed and stated they would change the template. They also questioned if this issue should be a finding or observation. **10/31/2018.** NIOSH confirmed that the template had been revised.	**11/20/2017.** SPR changed issue to observation and status was put in abeyance. **10/31/2018.** SPR closed the finding.

Issue resolution for PER-059 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
5/22/2017	SC&A was able to derive NIOSH's 1962–1963 air concentration and daily intake values for thorium; however, corresponding values for uranium derived by SC&A are a factor of 2 lower than values derived/assigned for uranium air concentration and intakes.	**11/20/2017.** NIOSH agreed that uranium intakes were in error and stated they would change the template. **10/31/2018.** NIOSH confirmed that the template had been revised.	**11/20/2017.** SPR placed this finding in abeyance until the template is revised. **10/31/2018.** SPR closed the finding.

Subtask 3 review of PER-059

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH identified cases for reevaluation as follows:
  - 54 previously completed claims with POC values ≤50% were identified for further evaluation
  - Nine of the 54 claims had employment periods prior to 1962 and were therefore not impacted by PER-059
  - Two additional claims were removed: one claim had recently been completed using the revised template and the other had been returned by DOL and was reevaluated by NIOSH as required by PER-059
  - Remaining 43 claims have been reevaluated by NIOSH in accordance with the revised Norton Company template and all applicable/approved DR protocols
  - All 43 revised DRs yielded POC values below 45%

SC&A's conclusion about NIOSH's case selection process for PER-059

- SC&A concurs with NIOSH's selection criteria for defining the 43 claims requiring reevaluation of dose
- There were no findings under subtask 3

Subtask 4 case selection criteria for PER-059

- SC&A recommended selection of cases based on following criteria:
  - Assignment of the template-prescribed annual values for external doses
  - Assignment of internal intake rates for uranium, thorium, and thoron
  - Employment after 1961

PER-059 subtask 4 review of 1 reworked case

- ABRWH selected one reworked case for SC&A's review in April 2021, based on the following criteria:
  - assignment of external dose during the residual period
  - assignment of internal dose during the residual period
- SC&A reviewed the reworked case in December 2021 to determine if external and internal doses were correctly assessed in accordance with PER-059

NIOSH's reworked DR for PER-059 case

- NIOSH's rework of the case:
  - Used applicable DR tools
  - Recalculated all annual doses
  - Re-ran IREP
- Revised DR report not sent to DOL because the compensation decision did not change

Case background for PER-059 case

- EE worked at Norton Company for multiple brief periods during the residual period
- EE was not monitored for radiation exposure
- Diagnosed with qualifying cancer over two decades after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-059 case

- Original DR calculated external and internal doses of <0.001 rem
- Reworked DR calculated modest external and internal doses

Comparison of external dose calculations for PER-059 case

Original DR

- Used guidance in template available in 2010 for external dose during the residual period
- No prorating for partial years of employment
- Applied DCF of 1.000
- Derived dose of <0.001 rem

Reworked DR

- Used residual period external exposure values from updated 2011 template
- No prorating for partial years of employment.
- Applied exposure DCF of 1.44 for the thyroid as the surrogate organ
- Assigned dose of ~0.030 rem

SC&A's conclusions on external dose for PER-059 case

- Appropriate dose values selected from revised template
- Correct surrogate organ was selected, based on OTIB-0005, rev. 05
- Appropriate DCF value was applied
- No partial-year prorating applied, as an efficiency and claimant-favorable measure
- Review confirmed doses were accurately entered in IREP
- As expected, reworked DR external dose increased from that calculated in the original DR
- SC&A had no findings about reworked external dose

Comparison of internal dose calculations for PER-059 case

Original DR

- Inhalation and ingestion intakes from DR methodology template
- Used CADW to compare doses from U-234 absorption types M and S with Th-232 absorption types M and S, with Th-232 type M resulting in the highest dose
- Calculated dose of <0.001 rem

Reworked DR

- Used inhalation and ingestion exposure values from updated template
- Assumed isotopic mix of U-234, Th-232, Th-228, Ac-228, Ra-228, Ra-224, and Rn-220
- Compared solubility types M and S, with type M resulting in more claimant-favorable dose
- Using CADW, calculated dose of <0.020 rem

SC&A's conclusions on internal dose for PER-059 case

- Reviewed NIOSH's CADW files for the reworked DR and confirmed that correct intake values were used, based on data in updated template
- SC&A verified:
  - Type M solubility resulted in the higher dose
  - Dose data appropriately entered in IREP table
  - Doses were assessed to the date of cancer diagnoses
- SC&A had no findings about the assessment of internal dose in the reworked case

Board discussion of DCAS-PER-059