Summary of Seven 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

- ORAUT-OTIB-0014, rev. 00, “Technical Information Bulletin – Assignment of Environmental Internal Doses for Employees Not Exposed to Airborne Radionuclides in the Workplace”
- ORAUT-PROC-0002, rev. 00, “Use of Integrated Modules for Bioassay Analysis (IMBA)”
- ORAUT-PROC-0077, rev. 00, “Dose Reconstruction Error Tracking and Reporting”
- OCAS-PER-003, rev. 0, “Evaluation of the Effect of Adding Ingestion Intakes to Bethlehem Steel Cases”
- OCAS-PER-025, rev. 0, “Huntington Pilot Plant TBD Revision”
- DCAS-PER-033, rev. 0, “Reduction Pilot Plant TBD Revision”
- DCAS-PER-038, rev. 0, “Hooker Electrochemical TBD Revisions”

ORAUT-OTIB-0014, rev. 00

- Title: “Technical Information Bulletin – Assignment of Environmental Internal Doses for Employees Not Exposed to Airborne Radionuclides in the Workplace”
- Issued June 22, 2004
- Provides guidance to the dose reconstructor on:
  - when to assign environmental internal doses rather than workplace exposures to workers
  - the methodology for assigning such doses

SC&A's review of OTIB-0014, rev. 00

- Review submitted June 8, 2006
- Review identified one finding
- Finding discussed at the September and November 2007 SPR meetings and resolved during April 11, 2012, SPR meeting

Issue resolution for OTIB-0014 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Particular care must be taken when assigning a construction worker to a given category of exposure due to the highly diverse nature of exposures that some construction workers experience.	**9/25/2007.** NIOSH agrees. ORAUT-OTIB-0052 provides additional guidance regarding construction workers.	**11/7/2007**. SPR transferred finding to OTIB-0052.

Issue resolution for OTIB-0014 finding 1 followup

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Particular care must be taken when assigning a construction worker to a given category of exposure due to the highly diverse nature of exposures that some construction workers experience.	**12/16/2011.** OTIB-0014 provides guidance on assigning environmental internal doses. Unmonitored CTWs are not assigned environmental internal doses since they are assumed to be more highly exposed and better represented by the population of monitored CTWs. OTIB-0052, rev. 01, section 8.4, requires that internal doses for unmonitored CTWs be assigned using 50th percentile of coworker population with the applicable GSD. Therefore, OTIB-0014 does not apply to either monitored or unmonitored CTWs.	**4/11/2012.** SPR agreed with NIOSH's response and closed the finding.

Board discussion of ORAUT-OTIB-0014

ORAUT-PROC-0002, rev. 00

- Title: “Use of Integrated Modules for Bioassay Analysis (IMBA)”
- Issued August 14, 2003
- Provides guidance to the dose reconstructor on:
  - running the IMBA software
  - required IMBA documentation and file creation process for the NIOSH dose reconstruction (DR) process

SC&A's review of PROC-0002, rev. 00

- Review submitted January 17, 2005
- Review identified three findings
- Finding discussed and resolved during the July 27, 2006, SPR meeting

Issue resolution for PROC-0002 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
1/17/2005	Procedure lacks clear descriptions for location of various functional buttons related to the IMBA program (i.e., “Start Calculation” button)	**7/27/2006.** NIOSH does not feel that these comments warrant revision to the procedure. The procedure provides sufficient detail so that a novice user can operate IMBA with a little effort. After only brief experience, the user has no need for the additional specificity called for by this comment.	**7/27/2006.** SPR agreed with NIOSH’s response and closed the finding.

Issue resolution for PROC-0002 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
1/17/2005	Procedure lacks sufficient guidance on evaluating results of bioassay calculations (i.e., modifying fit data).	**7/27/2006.** NIOSH does not feel that these comments warrant revision to the procedure. The procedure only provides guidance on general use of IMBA. It does not provide the dose reconstructor with the necessary tools and experience to reconstruct internal dose.	**7/27/2006.** SPR agreed with NIOSH's response and closed the finding.

Issue resolution for PROC-0002 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Procedure is inadequate with regard to providing IMBA users with more guidance requiring professional judgments (i.e., modifying bioassay input assumption to establish better fit of data).	**7/27/2006.** NIOSH does not feel that these comments warrant revision to the procedure. The procedure only provides guidance on general use of IMBA. It does not provide the dose reconstructor with the necessary tools and experience to reconstruct internal dose.	**7/27/2006.** SPR agreed with NIOSH's response and closed the finding.

Board discussion of ORAUT-PROC-0002

ORAUT-PROC-0077, rev. 00

- Title: “Dose Reconstruction Error Tracking and Reporting”
- Issued March 28, 2005
- Provides process for review, disposition, correction, tracking, and trending of DR report errors and comments received by ORAUT

SC&A's review of PROC-0077, rev. 00

- Review submitted June 8, 2006
- Review identified three findings
- Findings resolved during the August 21, 2008, SPR meeting

Issue resolution for PROC-0077 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Discuss how this procedure fits into the overall ORAUT QA program.	**9/25/2007.** This procedure serves as one part of the overall Quality Management System (QMS) for the ORAU Team Dose Reconstruction Project, which is modeled on the requirements of ISO 9001:2000E, Quality Management Systems-Requirements.	**8/21/2008.** SPR agreed with NIOSH's response and closed the finding.

Issue resolution for PROC-0077 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	The user would benefit from a flowchart keyed to text sections.	**9/25/2007.** We will consider adding a flowchart to the procedure the next time the procedure is modified or during the next biennial review.	**8/21/2008.** SPR agreed with NIOSH's response and closed the finding.

Issue resolution for PROC-0077 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
6/8/2006	Reference to financial incentives does not belong in a QA procedure.	**9/25/2007**. The financial incentive was not a driver for section 4.5 of the procedure. The CPAF goals represent measurable expectations from NIOSH that are based on provisions of EEOICPA, which ultimately benefit the energy employee (EE). NIOSH will consider modifying the text of section 4.5 the next time the procedure is modified or during the next biennial review.	**8/21/2008.** SPR agreed with NIOSH's response and closed the finding.

Board discussion of ORAUT-PROC-0077

OCAS-PER-003, rev. 0

- Title: “Evaluation of the Effect of Adding Ingestion Intakes to Bethlehem Steel Cases”
- Issued January 28, 2005
- Determines the impact of changes to the Bethlehem Steel TBD
- Revision 01 of ORAUT-TKBS-0001 added intakes of uranium through the ingestion pathway
- Ingestion intakes will be assessed based on a fixed percentage of the inhalation intake
- Increase in dose will vary for each organ

SC&A's review of PER-003, rev. 0

- Review submitted October 29, 2007
- Review identified four findings
- Findings discussed during December 9, 2008, and May 16, 2016, SPR meetings
- Protocol prior to June 23, 2007, did not require case reviews

Issue resolution for PER-003 finding 1

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	Document title is misleading. It does not deal solely with ingestion component, but also recalculates the probability of causation (POC) and includes updated occupational x-ray data.	**12/9/2008.** Any time claims are reworked, they are completed in accordance with all current guidelines. Consequently, the revised occupational medical doses were included in the reworked claims.	**12/9/2008.** SC&A agreed with NIOSH's response. The SPR closed the finding.

Issue resolution for PER-003 finding 2

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	PER does not specify which specific intake parameters it utilizes in determining the annual percent increase dose. The technical basis document (TBD) lists high-sided and low-sided estimate for inhalation.	**12/9/2008.** Intake parameters utilized in calculating ingestion are based on the high side of estimates.	**12/9/2008.** SC&A agreed with NIOSH's response. The SPR closed the finding.

Issue resolution for PER-003 finding 3

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	The method used in order to produce a more precise POC is not clearly explained. If this methods stems from the IREP User's Guide, this document should be referenced. Also, additional information concerning the "average" value should be added.	**12/9/2008.** NIOSH agrees that the IREP user's guide should be referenced in the TBD.	**12/9/2008.** SPR changed status of finding to in abeyance awaiting a change to the TBD.

Issue resolution for PER-003 finding 3 followup

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	The method used in order to produce a more precise POC is not clearly explained. If this methods stems from the IREP User's Guide, this document should be referenced.	**5/16/2016.** In retrospect, NIOSH questioned the relevance of making this change.	**5/16/2016.** SC&A agreed, since the process of calculating a POC, as explained, is a standard protocol and would not have a significant impact on the TBD. SPR closed the finding.

Issue resolution for PER-003 finding 4

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	Absorption type S appears to be the most claimant favorable for all organs except the respiratory tract organ (ET1).	**12/9/2008.** NIOSH provided no response.	**12/9/2008.** SPR kept the finding open.

Issue resolution for PER-003 finding 4 followup

Finding date	Finding description	NIOSH response	Finding resolution
10/29/2007	Absorption type S appears to be the most claimant favorable for all organs except the respiratory tract organ (ET1).	**5/16/2016.** There were no cases evaluated in behalf of PER-003 that involved ET1.	**5/16/2016.** SC&A did not have a complete list of all reworked cases but accepts NIOSH's response. SPR closed the finding.

Board discussion of OCAS-PER-003

Huntington Pilot Plant PERs

- OCAS-PER-025, rev. 0, “Huntington Pilot Plant TBD Revision”
- DCAS-PER-033, rev. 0, “Reduction Pilot Plant TBD Revision”
- SC&A reviewed both PERs in its July 18, 2013, report

History of Huntington Pilot Plant TBD

- ORAUT-TKBS-0004, “Technical Basis Document: Basis for Development of an Exposure Matrix for Huntington Pilot Plant,” rev. 00 (October 2003)
- ORAUT-TKBS-0004, rev. 01 (January 2004)
- OCAS-PER-025 (September 2007) evaluated addition of electron dose in ORAUT-TKBS-0004, rev. 01
- OCAS-TKBS-0004, “Technical Basis Document for the Huntington Pilot Plant, Huntington, West Virginia,” rev. 00 (August 2008), added intakes for total uranium, Pu-239, and Np-237
- DCAS-PER-033 (December 2011) evaluated increase in internal dose from OCAS-TKBS-0004, rev. 00
- DCAS-TKBS-0004, “Technical Basis Document for the Huntington Pilot Plant, Huntington, West Virginia,” rev. 01 (December 2013), added intakes for Am-241, Th-230, and Tc-99
- DCAS-PER-066 (November 2015) evaluated increase in internal dose in OCAS-TKBS-0004, rev. 01

SC&A's review of Huntington Pilot Plant documents

- SC&A's previous reviews included:
  - Attachment 3 to the 8th set of DR audit reports (reviewed May 2008)
  - OCAS-TKBS-0004, rev. 00 (focused review under Subcommittee for Dose Reconstruction Reviews) (reviewed March 2013)
  - OCAS-PER-025, rev. 0 (reviewed July 2013)
  - OCAS-TKBS-0004, rev. 00 (reviewed June 2013)
  - DCAS-PER-033, rev. 0 (reviewed July 2013)
  - DCAS-PER-066, rev. 0 (reviewed October 2016) – the Board approved this document review at the August 18, 2022, meeting

Huntington Pilot Plant history

- Alternative name: Reduction Pilot Plant
- Covered period: 1951–1963, 1978–1979
- Supplied nickel powder used to make gaseous diffusion barrier for Paducah and Portsmouth gaseous diffusion plants
- Sources of feed material were nickel oxide and barrier scrap contaminated with uranium and associated radionuclides from the uranium enrichment process

OCAS-PER-025, rev. 0

- Title: “Huntington Pilot Plant TBD Revision”
- Issued September 28, 2007
- Determines the impact of revision 01 changes to the Huntington Pilot Plant TBD
- Revision added external electron dose
- Revision impacted cases where the external target organ was skin, breast, or testes

DCAS-PER-033, rev. 0

- Title: “Reduction Pilot Plant TBD Revision”
- Issued December 9, 2011
- Determines the impact of changes introduced in the Huntington Pilot Plant TBD, OCAS-TKBS-0004, which superseded ORAUT-TKBS-0004
- Revision modified operator inhalation intakes from 3.83 pCi/day to 44 pCi/day
- Revision decreased dose in other exposure pathways

Subtask 1 review of PER-025, rev. 0, and PER-033, rev. 0

- Subtask 1: Assess NIOSH's evaluation of the issues prompting PERs and their potential impact on DR
- SC&A reviewed technical changes to applicable revisions of the TBD
- Confirmed electron doses were added and require assessment of skin, breast, and testes doses in ORAUT-TKBS-0004, rev. 01, as addressed under PER-025
- Verified OCAS-TKBS-0004, rev. 00, modified inhalation intakes for operators, prompting PER-033 to evaluate impact of increased internal dose
- No findings under subtask 1

Subtask 2 review of PER-025, rev. 0, and PER-033, rev. 0

- Subtask 2: Assess NIOSH's specific methods for corrective action
- SC&A reviewed previous versions of TBD
- Confirmed PER-025 corrective actions properly address ORAUT-TKBS-0004, rev. 01, modifications
- Confirmed PER-033 corrective actions properly address revisions in OCAS-TKBS-0004, rev. 00
- No findings under subtask 2

Subtask 3 review of PER-025, rev. 0

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH identified one case completed for the target organs with POC <50% prior to TBD revision
- SC&A searched NOCTS to verify only one case impacted
- SC&A verified NIOSH reworked the one case
- SC&A had no findings under subtask 3 for PER-025

Subtask 3 review of PER-033, rev. 0

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH identified 32 cases:
  - POC <50% prior to TBD revision
  - employed between 1956–1963 or 1978–1979
- NIOSH's rework of cases:
  - 12 cases resulted in higher POC
  - 20 cases resulted in decreased POC
  - highest reworked POC did not exceed 50%
- SC&A searched NOCTS to verify 32 cases impacted
- SC&A verified NIOSH reworked the 32 cases
- SC&A had no findings under subtask 3 for PER-033

Subtask 4 review of PER-025, rev. 0, and PER-033, rev. 0

- Subtask 4: Conduct audits of a sample set of DRs affected by PER
- PER-025 evaluated only 1 case; SC&A recommended reviewing this case
- PER-033 evaluated 32 cases; SC&A recommended selecting cases based on the criteria:
  - Internal dose assigned during 1956–1963 and/or 1978–1979
  - Shallow dose assigned to the hands and forearms for equipment operator or maintenance worker during 1956–1963 and/or 1978–1979

PER-025 subtask 4 case review process

- SC&A submitted its subtask 4 review of PER-025 on December 5, 2013
- SC&A presented its review to the SPR at the February 13, 2014, meeting
- SC&A reviewed the one case impacted by PER-025
- Review evaluated only shallow dose calculations, as addressed under PER-025
- SC&A identified one finding

PER-025 case background

- EE worked at Huntington Pilot Plant for many years during the covered period
- No records of external or internal monitoring available
- EE classified as a production worker
- Diagnosed with a qualifying cancer while employed

Comparison of NIOSH's reworked doses and original doses for PER-025 case

Dose categories	Reworked vs. original dose percentage
External	~87% decrease
Occupational medical	~96% decrease
Internal	~174% increase
Total	~82% decrease
POC	~89% increase

Original shallow dose for PER-025 case

- DR performed in 2003
- TBD did not recommend assigning shallow dose
- No shallow dose assigned

Reworked shallow dose for PER-025 case

- Case was reworked for PER-025 and change in employment dates
- Rework calculated external and internal doses based on production worker category
- However, rework did not include shallow dose

Issue resolution for PER-025 subtask 4, finding 1

Finding date	Finding description	NIOSH followup	Finding resolution
12/5/2013	Since worker had potential for shallow dose and case resubmitted for DR based on PER-025, shallow dose should have been assigned. SC&A calculated the shallow dose, which would have added 0.018 rem/yr for 4 years of employment.	**2/13/2014.** NIOSH agrees. Upon further review, NIOSH determined that an error correction would not impact compensability. Therefore, no further action is necessary.	**2/13/2014.** SPR closed finding.

PER-033 case reviews

- Two cases selected for review
- Subtask 4 review submitted January 15, 2014
- SC&A presented its report to the SPR at the February 13, 2014, meeting
- Review evaluated shallow dose to the hand/forearm and internal dose
- SC&A had no findings

PER-033 case 1 background

- EE worked at Huntington Pilot Plant for several years
- EE worked throughout the site
- No records of external or internal monitoring available
- Diagnosed with qualifying cancer many years after termination of employment

Comparison of NIOSH's reworked doses and original doses for PER-033 case 1

Dose categories	Reworked vs. original dose percentage
External photon	~69% decrease
External electron	~77% decrease
Occupational medical	~145% increase
Internal	~87% increase
Total	~52% decrease
POC	~42% decrease

Original internal and shallow dose calculations for PER-033 case 1

- DR performed in 2004 as an overestimate of dose
- Internal dose:
  - Used internal intake values from table 5 of ORAUT-TKBS-0004, rev. 01
  - Calculated doses using the chronic annual dose workbook (CADW)
  - Total internal dose of less than 0.010 rem assigned
- Shallow dose:
  - Annual dose of 0.85 rem assigned to hand/forearm, based on OCAS-TKBS-0004, rev. 00
  - Entered in IREP as electrons >15 keV

Reworked internal and shallow dose calculations for PER-033 case 1

- Internal dose:
  - Used production worker inhalation and ingestion intake values from table 5 of OCAS-TKBS-0004, rev. 00
  - Calculated doses using CADW for total uranium, Pu-239, Np-237
  - Compared absorption types as specified in table 5
  - Resulted in assigning a total internal dose of <0.100 rem
- Shallow dose:
  - Annual shallow dose of 0.270 rem assigned, based on nonoperator values in table 6 of OCAS-TKBS-0004, rev. 00

SC&A's conclusions about internal and shallow dose calculations for PER-033 case 1

- Concurs that EE should be classified as a nonproduction worker
- Internal dose:
  - Verified correct inhalation and ingestion intake values taken from table 5 of OCAS-TKBS-0004, rev. 00
  - Confirmed the greater dose was assigned considering the potential solubility types
  - Verified intake values appropriately entered in CADW
- Shallow dose:
  - Confirmed correct shallow dose values assigned
  - Annual doses correctly entered in IREP
- No findings about the rework of case 1

PER-033 case 2 background

- EE worked at Huntington Pilot Plant for many consecutive years
- EE worked throughout the site
- No records of external or internal monitoring available
- Diagnosed with qualifying cancer during employment period

Comparison of NIOSH's reworked doses and original doses for PER-033 case 2

Dose categories	Reworked vs. original dose percentage
External	~75% decrease
Occupational medical	~37% decrease
Internal	~727% increase
Total	~250% increase
POC	~56% increase

Original internal dose calculations for PER-033 case 2

- DR performed in 2003 as an overestimate of dose
- Used internal intake values from table 5 of ORAUT-TKBS-0004, rev. 00
- Calculated doses using CADW
- Total internal dose of >2.0 rem assigned

Reworked internal dose calculations for PER-033 case 2

- Used production worker inhalation and ingestion intake values from table 5 of OCAS-TKBS-0004, rev. 00
- Calculated doses using CADW for total uranium, Pu-239, Np-237
- Compared absorption types as specified in table 5
- Resulted in assigning a total internal dose of >18.0 rem

SC&A's conclusions about internal calculations for PER-033 case 2

- Concurs that EE should be classified as a production worker
- Verified correct inhalation and ingestion intake values taken from table 5 of OCAS-TKBS-0004, rev. 00
- Confirmed the greater dose was assigned considering the potential solubility types
- Verified intake values correctly entered in CADW
- No findings about the rework of case 2

Board discussion of OCAS-PER-025 and DCAS-PER-033

DCAS-PER-038, rev. 0

- Title: “Hooker Electrochemical TBD Revisions”
- Issued July 24, 2012
- Determines the impact of changes to the Hooker Electrochemical TBDs

Hooker Electrochemical TBD history

- Initial guidance in Battelle-TBD-6001 (appendix AA), June 15, 2007
- Stand-alone TBD (DCAS-TKBS-0009) issued April 4, 2011
  - Uranium intakes increased during the operational years for nonoperator intakes
  - Shallow dose rates increased during the residual period for all job categories
- Revision 1 to DCAS-TKBS-0009 issued June 16, 2011
  - Corrected errors in tables 2, 3, and 6
  - Changes caused external doses to operators to decrease during the operational period

SC&A's review of PER-038, rev. 0

- Subtask 1–3 review submitted May 20, 2013
- No findings identified
- Review discussed during the November 7, 2013, SPR meeting
- Subtask 4 (case review) submitted October 16, 2014
- No findings identified
- Subtask 4 report discussed at the November 25, 2014, SPR meeting

Subtask 1 review of PER-038, rev. 0

- Subtask 1: Assess NIOSH's evaluation of the issues prompting PERs and their potential impact on DR
- SC&A compared changes made in applicable revisions of DCAS-TKBS-0009
- Confirmed:
  - Uranium intakes increased for nonoperators during operations years in TBD rev. 0
  - Shallow dose rates added for all job categories during the residual period in TBD rev. 0
  - Uranium intakes decreased for operators during operational years in TBD rev. 1
- No doses or intakes were higher in TBD rev. 1
- No findings under subtask 1

Subtask 2 review of PER-038, rev. 0

- Subtask 2: Assess NIOSH's specific methods for corrective action
- SC&A reviewed Battelle-TBD-6001, appendix AA, in September 2010
- SC&A reviewed DCAS-TKBS-0009, rev. 1, in March 2013
  - Review identified 6 findings
  - Findings resolved under the URAWE Work Group
- Confirmed PER-038 corrective actions properly address ORAUT-TKBS-0009, rev. 0 and rev. 1, modifications
- No findings under subtask 2

PER-038 subtask 3 population criteria

- Subtask 3: Evaluate PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH identified two populations of potentially affected cases:
  - **Population 1:**
    - POC <50%
    - DR approved on or prior to April 4, 2011 (issue date of TBD rev. 0)
    - Employed at Hooker during the residual period
    - Diagnosed with nonqualifying cancer (only shallow dose increased)
    - 14 cases identified
  - **Population 2:**
    - POC <50%
    - DR approved on or prior to April 4, 2011 (issue date of TBD rev. 0)
    - Employed at Hooker during operational period
    - 39 cases identified

PER-038 subtask 3 DR reworks

- NIOSH's rework of cases:
  - 53 total cases identified
  - 33 cases assigned to operator category
  - 20 cases reevaluated
- Reevaluation results:
  - POC <45% for 19 cases
  - POC 45–50% for 1 case

SC&A's subtask 3 review of PER-038

- Concurs with selection criteria
- Determined selection criteria encompass the universe of potentially affected DRs
- Verified none of these DRs exceed a 50% POC
- SC&A had no findings under subtask 3

Subtask 4 review of PER-038, rev. 0

- Subtask 4: Conduct audits of a sample set of DRs affected by PER
- SC&A recommended that audits be deferred until DCAS-TKBS-0009, rev. 1, findings were resolved
- Advisory Board ultimately selected 3 cases for review

PER-038 case reviews

- Subtask 4 review of 3 cases submitted October 16, 2014
- Review evaluated reworked external and internal doses
- NIOSH's rework documented in a one-page MS Word file
- All POCs <50%; therefore, no formal DR revision performed or submitted to U.S. Department of Labor

PER-038 case 1 background

- EE worked at Hooker for during operational period and portion of residual period
- EE worked throughout the site
- No records of external or internal monitoring available
- Diagnosed with qualifying cancer after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-038 case 1

Dose categories	Reworked vs. original dose percentage
External	~99% decrease
Occupational medical	No change
Internal	~77% increase
Total	~39% increase
POC	~39% increase

Original external dose calculations for PER-038 case 1

- DR performed in 2008 as an overestimate of dose
- Assumed EE's job category nonoperator
- Used external dose values from table AA.3 of Battelle-TBD-6001, appendix AA
- Applied applicable exposure-to-organ dose conversion factor (DCF) value
- Assigned annual doses as 100% 30–250 keV in IREP
- Total external dose of ~2 rem assigned

Reworked external dose calculations for PER-038 case 1

- Assumed EE's job category as operator
- Used "material" and "contamination" values from table 5 of DCAS-TKBS-0009, rev. 1, for operational period
- Used values from table 6 of DCAS-TKBS-0009, rev. 1, for residual period
- Applied applicable exposure-to-organ DCF value
- Assigned annual doses as 100% 30–250 keV in IREP
- Total external dose of <0.100 rem calculated

Original internal dose calculations for PER-038 case 1

- No bioassay records identified
- Assumed EE directly involved in uranium operations and source material was inhaled and ingested
- Used internal intake values for nonoperator from table AA.1 of Battelle-TBD-6001, appendix AA
- Calculated doses using IMBA and assuming type S solubility
- Total internal dose of nearly 8 rem assigned

Reworked internal dose calculations for PER-038 case 1

- Used inhalation and ingestion intake values in DCAS-TKBS-0009, rev. 1, for operational and residual periods
- Compared solubility types M and S in IMBA, with type S resulting in higher dose
- Annual alpha doses entered in IREP as constants
- Calculated total internal dose of >14 rem

SC&A's conclusions about external and internal calculations for PER-038 case 1

- External dose:
  - Confirmed appropriate operator values used from table 5 of TBD rev. 1 for operational period
  - Confirmed appropriate residual doses selected from table 6 of TBD rev. 1
  - *Noted:* TBD recommends operational period contamination dose distributions of 80.3% <30 keV, 12.3% 30–250 keV, and 7.5% <250 keV; assuming 100% 30–250 keV is claimant favorable and resulted in slight increase in POC
- Internal dose:
  - Verified correct inhalation and ingestion intake values taken from DCAS-TKBS-0009, rev. 1
  - Confirmed greater dose was assigned considering solubility types M and S
  - Doses entered in IREP with appropriate exposure parameters and dose distribution
- SC&A re-ran IREP and confirmed NIOSH's POC value
- No findings about the rework of case 1

PER-038 case 2 background

- EE worked at Hooker for during operational period and portion of residual period
- EE worked in a nonoperator role
- No records of external or internal monitoring available
- Diagnosed with qualifying cancer many years after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-038 case 2

Dose categories	Reworked vs. original dose percentage
External	~87% decrease
Occupational medical	Modest decrease
Internal	~1922% increase
Total	~1618% increase
POC	~1010% increase

Original external dose calculations for PER-038 case 2

- DR performed in 2008 using claimant-favorable assumptions
- Assumed EE's job category as nonoperator
- Used external dose values from table AA.3 of Battelle-TBD-6001, appendix AA
- Applied applicable exposure-to-organ DCF value
- Assigned annual doses as 100% 30–250 keV in IREP
- Total external dose of <0.100 rem assigned

Reworked external dose calculations for PER-038 case 2

- Assumed EE's job category as operator/laborer
- Used "material" and "contamination" values from table 5 of DCAS-TKBS-0009, rev. 1, for operational period
- Used values from table 6 of DCAS-TKBS-0009, rev. 1, for residual period
- Applied applicable exposure-to-organ DCF value
- Assigned annual doses as 100% 30–250 keV in IREP
- Total external dose of <0.010 rem calculated

Original internal dose calculations for PER-038 case 2

- No bioassay records identified
- Assumed EE directly involved in uranium operations and source material was inhaled and ingested
- Used internal intake values for clerical worker from table AA.1 of Battelle-TBD-6001, appendix AA
- Calculated doses using IMBA and assuming type S solubility
- Total internal dose of <1.0 rem assigned

Reworked internal dose calculations for PER-038 case 2

- Used inhalation and ingestion intake values from DCAS-TKBS-0009, rev. 1, for operational and residual periods
- Assumed 3 intake regimes: operational inhalation, operation ingestion, and residual inhalation
- Compared solubility types M and S in IMBA, with type S resulting in higher dose
- Annual alpha doses entered in IREP as constants
- Calculated total internal dose of >13 rem

SC&A's conclusions about external and internal calculations for PER-038 case 2

- External dose:
  - Confirmed appropriate operator values used from table 5 of TBD rev. 1 for operational period
  - Confirmed appropriate residual doses selected from table 6 of TBD rev. 1
  - *Noted:* TBD recommends operational period contamination dose distributions of 80.3% <30 keV, 12.3% 30–250 keV, and 7.5% <250 keV; using 100% 30–250 keV is claimant favorable and resulted in slight increase in POC
- Internal dose:
  - Verified correct inhalation and ingestion intake values taken from DCAS-TKBS-0009, rev. 1
  - Confirmed greater dose was assigned considering solubility types M and S
  - Doses entered in IREP with appropriate exposure parameters and dose distribution
- SC&A re-ran IREP and confirmed NIOSH's POC value
- No findings about the rework of case 2

PER-038 case 3 background

- EE worked at Hooker briefly during operational period and the entire residual period
- EE worked throughout the plant
- No records of external or internal monitoring available
- Diagnosed with qualifying cancers many years after employment termination

Comparison of NIOSH's reworked doses and original doses for PER-038 case 3

Dose categories	Reworked vs. original dose percentage for cancer 1	Reworked vs. original dose percentage for cancer 2
External	~67% decrease	~100% decrease
Occupational medical	No change	Modest decrease
Internal	No change	~48,800% increase
Total	~63% decrease	~62% decrease
POC	(a)	(a)

(a) Combined reworked POC decreased 22% versus the combined original POC.

Original external dose calculations for PER-038 case 3

- DR performed in 2010 using claimant-favorable assumptions
- Assumed EE's job category as an operator
- Used external dose values from table AA.3 of Battelle-TBD-6001, appendix AA
- Applied applicable exposure-to-organ DCF values
- Assigned annual doses as 100% 30–250 keV in IREP
- Total external dose of >3.0 rem assigned to cancer 1
- Total external dose of >5.0 rem assigned to cancer 2

Reworked external dose calculations for PER-038 case 3

- Assumed EE's job category as operator/laborer
- Used "material" and "contamination" values from table 5 of DCAS-TKBS-0009, rev. 1, for operational period
- Operational doses corrected for partial year of exposure
- Used values from table 6 of DCAS-TKBS-0009, rev. 1, for residual period
- Applied applicable exposure-to-organ DCF values
- Assigned annual doses as 100% 30–250 keV in IREP
- Total cancer 1 external dose assigned:
  - photon dose of <0.100 rem
  - electron dose of >1.0 rem
- Total external dose of <0.100 rem assigned for cancer 2

Original internal dose calculations for PER-038 case 3

- No bioassay records identified
- Assumed EE directly involved in uranium operations and source material was inhaled and ingested
- Used internal intake values for operator from table AA.1 of Battelle-TBD-6001, appendix AA
- Calculated doses using IMBA and assuming type M solubility
- Total internal dose of <0.100 rem assigned to cancers 1 and 2

Reworked internal dose calculations for PER-038 case 3

- Used inhalation and ingestion intake values from DCAS-TKBS-0009, rev. 1, for operational and residual periods
- Assumed 3 intake regimes: operational inhalation, operation ingestion, and residual inhalation
- Compared solubility types M and S in IMBA, with type M resulting in higher dose for cancer 1 and type S for cancer 2
- Annual alpha doses entered in IREP as constants
- Calculated total internal dose of <0.100 rem for cancer 1
- Calculated total internal dose of nearly 2.0 rem for cancer 2

SC&A's conclusions about external dose calculations for PER-038 case 3

- Confirmed appropriate operator values used from table 5 of TBD rev. 1 for operational period
- Confirmed appropriate residual doses selected from table 6 of TBD rev. 1
- SC&A's calculations matched NIOSH's assigned doses
- *Noted:* TBD recommends entering operational period contamination doses in IREP as 80.3% <30 keV, 12.3% 30–250 keV, and 7.5% <250 keV; using 100% 30–250 keV is claimant favorable and resulted in slight increase in POC

SC&A's conclusions about internal dose and POC calculations for PER-038 case 3

- Internal dose:
  - Verified correct inhalation and ingestion intake values taken from DCAS-TKBS-0009, rev. 1
  - Confirmed greater dose was assigned considering solubility types M and S
  - SC&A was able to recalculate doses that matched NIOSH's assigned doses
  - Doses entered in IREP with appropriate exposure parameters and dose distribution
- SC&A re-ran IREP and confirmed NIOSH's POC value
- No findings about the rework of case 3

Board discussion of DCAS-PER-038