Overview of Previously Presented Procedure Reviews

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Previous presentations with no formal closeout

- March 12, 2013
  - ORAUT-OTIB-0052
  - ORAUT-OTIB-0070
  - OCAS-IG-001
- July 17, 2013
  - OCAS-TIB-0010
  - ORAUT-OTIB-0023
- October 17, 2013
  - OCAS-PER-012
  - ORAUT-OTIB-0010
- November 6, 2014
  - OCAS-PER-014
- December 13, 2017
  - ORAUT-OTIB-0020
  - ORAUT-OTIB-0052
- April 11, 2018 (closeout deferred awaiting NIOSH followup)
  - ORAUT-OTIB-0017
  - NIOSH-OVER-0009

ORAUT-OTIB-0070, rev. 00

- Title: “Dose Reconstruction during Residual Radioactivity Periods at Atomic Weapons Employer Facilities”
- Provides guidance for reconstruction of internal doses due to resuspension of particulate surface contamination
- Reviewed by SC&A August 2008
- Presented to Board March 12, 2013

OTIB-0070 key findings and resolution

Finding (15 total)	Resolution
Several findings related to use of resuspension factor (RF) and derivation of source term depletion rate	Findings were adequately addressed in rev. 01
Many findings questioned attachment B use of air concentration survey data at thorium facilities	Attachment B was never used, and NIOSH eliminated it in rev. 01

OTIB-0070 Board discussions

Question	Response
Is default RF appropriate for outdoor setting?	Default RF is only used for indoor activities at facilities where post-operational cleanup has been performed
Is default RF applicable for all Atomic Weapons Employer sites?	OTIB specifies site-by-site analysis be conducted when no post-operational cleanup has been completed

OCAS-IG-001, rev. 01, 02, and 03

- Title: “External Dose Reconstruction Implementation Guideline”
- Provides general guidance on the components, standards, and methods for reconstructing external radiation dose for probability of causation (POC)
- Revision 01 reviewed by SC&A January 2005
- Revision 02 reviewed by SC&A October 2007
- Focused review of revision 03 by SC&A April 2012 to ensure all findings addressed
- Presented to Board March 12, 2013

IG-001 findings 1–10 and resolution

Finding (24 total)	Resolution
Several findings related to structure, clarity, and specificity of guidance	Findings adequately addressed in revision 01
Inappropriate limit of detection (LOD) values	Corrected in revision 02
Reconstruction of neutron doses in both revisions	Rev. 03 added neutron-to-photon ratios and discussion on evaluating missed neutron data
Underestimated dose conversion factors (DCFs) for bone, red marrow	Revision 02 added table of correction factors (CFs)

IG-001 findings 11–16 and resolution

Finding	Resolution
Underestimated DCFs for posterior-to-anterior, rotational, and isotropic geometries in both revisions	Anterior-to-posterior geometry recommended in site-specific documents and workbooks
Angular sensitivity not accounted for	Corrected in revision 02, which directs to site-specific documents
Dosimeter uncertainty/ selection of uncertainty distribution	Site-specific documents and workbook address these concerns

IG-001 Board discussions

Question	Response
Would IG-001 be used to assess film badge inadequacies?	IG-001 predates all other guidance and is general in nature. Film badge limitations addressed in site-specific documents.
Did SC&A's review consider experience gained in the dose reconstruction (DR) process?	SC&A's review was early in the DR process, so no such evaluation was possible.

OCAS-TIB-0010, rev. 02

- Title: “Best Estimate External Dose Reconstruction for Glovebox Workers”
- Provides correction factors for best-estimate DR to organs located in the lower torso from photons emanating from gloveboxes when a dosimeter is worn on the lapel
- Reviewed by SC&A in June 2006
- Presented to the Board July 17, 2013

TIB-0010 key findings and resolution

Finding (9 total)	Resolution
Lacks data on radioactive source, exact dimensions, locations, thickness of the walls	The requested information was added to appendix B.
Lower torso organs not specified	Information added to section 2.
Questions about design of analysis (finding 5), assumptions on glovebox model (finding 6), and Attila software (finding 8)	In abeyance 2/5/201; resolved by using of the 95th percentile instead of the mean for the CF. (NOTE: TIB-0010, rev. 04, still recommends mean value.)

TIB-0010 Board discussions

Question	Response
Were specific designs of gloveboxes used in the model?	Adjustments not made based on design; relied on geometric considerations.
Was shielding on the front of the glovebox but not underneath considered in the model?	Shielding was not considered; it is a geometric correction factor.
Did the model take into account the height of the workers?	Reference Man height used, but 95th percentile value would encompass badge to lowest organ.
Is the model adjusted for workers who wore lead aprons?	Not a question for the glovebox adjustment. It is a question for the interpretation of the badge location.
Is this model used as a best estimate?	Yes, used for best estimate to lower torso organs.

ORAUT-OTIB-0023, rev. 00

- Title: “Assignment of Missed Neutron Doses Based on Dosimeter Records”
- Provides information about when it is appropriate to assign missed neutron doses at DOE sites using the nLOD/2 method or an “alternative” method
- Reviewed by SC&A in June 2006
- Presented to Board July 17, 2013

OTIB-0023 key findings and resolution

Finding (8 total)	Resolution
Lack of clarity, inconsistent terminology, guidance inconsistent with IG-001	Corrected in rev. 01
Detailed information necessary for DR not available	Condition 1 (if neutron missed dose (nLOD/2) exceeds 75% of photon dose, missed dose not assigned) was eliminated in rev. 01, which resolves finding
Reconstruction of missed neutron dose unrealistic and neutron-to-photon assumptions not claimant favorable	Condition 1 was eliminated in rev. 01, which resolves finding

OTIB-0023 Board discussions

- Board members had no questions or comments about the review and finding resolution process for OTIB-0023.

ORAUT-OTIB-0010, rev. 00

- Title: “A Standard Complex-Wide Correction Factor for Overestimating External Doses Measured with Film Badge Dosimeters”
- Evaluates the degree of standardization of film dosimeters
- Develops a standard methodology to assign an overestimating organ dose.
- Reviewed by SC&A in January 2005
- Presented to Board October 17, 2013

OTIB-0010 key findings and resolution

Finding (10 total)	Resolution
Guidance lacking on how to treat missed or zero dosimetry data and issues of uncertainty	Table 2-1 added to rev. 01 with instruction on calculation of recorded and missed doses and how to enter into IREP
No guidance on CF when recorded dose >0 but <LOD	Rev. 01 specifies use of 40 mR as default LOD
Inconsistent guidance in OTIB-0010 and PROC-0006	PROC-0006 was revised and inconsistency corrected
CF of 2 and LOD value of 40 mR not overly conservative	When applied to every recorded and missed dose, respectively, it is considered sufficiently conservative

OTIB-0010 Board discussions

Question	Response
Is this OTIB currently in use, since overestimate approach was not being continued?	OTIB was still active but rarely used. Overestimating approach not completely removed due to time/expense.
Due to sensitivity of various film badges in use, is a 40 mR LOD reasonable?	It is a good value since the guidance uses 40 mR as LOD (not LOD/2) and maximizes the number of zeros.
In finding 9, what does the standard CF of 2 correct for?	CF corrects for film badge uncertainties.
How are missed doses compared to records with zeros, less than detectable, or blank cycles handled?	A recorded dose in a year is assumed to occur in one badge cycle. Then, missed doses are calculated for all other cycles.

OCAS-PER-012, rev. 00

- Title: “Evaluation of Highly Insoluble Plutonium Compounds”
- The existence of type SS plutonium (Pu) was assessed in ORAUT-OTIB-0049 and resulted in increased internal dose for specific organs, which prompted the issuance of PER-012
- Reviewed by SC&A in March 2010
- SC&A reviewed 9 DRs affected by PER-012 (Subtask 4) in July 2012
- Presented to Board October 17, 2013

PER-012 Subtasks 1 and 2 assessment and findings

Subtask	Action taken	Finding
Subtask 1: Assess circumstances that necessitated the PER	To account for longer retention and increased organ doses from type SS Pu, issued OTIB-0049, which specifies “dose adjustment factors” (generally factor of 4)	Review of OTIB-0049, OCAS-PEP-012,and PER-012 found NIOSH properly characterized the significance of highly insoluble. No findings.
Subtask 2: Assess specific methods for corrective action	PER-012 was prompted by OTIB-0049, which was critically reviewed by SC&A 10/29/2007	No findings.

PER-012 Subtasks 3 and 4 assessment and findings

Subtask	Action taken	Finding
Subtask 3: Evaluate approach for identifying the number of DRs requiring reevaluation	DRs affected (1) completed on or before 2/6/2007, (2) involved facilities with exposure to type SS Pu, and (3) POC was <50%.	SC&A agreed with methodology and had no findings.
Subtask 4: Recommend a sample of affected DRs for evaluation	Dose reevaluation is for 4 groupings of target tissues and is dictated by 1 of 4 monitoring methods.	SC&A recommended a minimum of 1 case be selected from 10 permutations. Board selected 9 cases.

PER-012 Subtask 4 case reviews assessments and findings

Subtask	Action taken	Finding
Subtask 4: Review a sample set of DRs affected by PER-012	Audit focused on assessing whether internal doses associated with type SS Pu were performed accurately and in accordance with guidance in OTIB-0049.	SC&A's audit concurred with approach/assumptions in calculating internal doses to highly insoluble Pu for all 9 cases. Methodology consistent with OTIB-0049. No findings.

PER-012 Board discussions

- Board members had no questions or comments about the review of PER-012 and evaluation of 9 impacted cases.

NIOSH-OVER-0009

- Title: “Skin Exposure”
- Addresses SC&A’s concerns about the modeling of fine and large particle deposition on the skin.
- Presented to Board April 11, 2018

OVER-0009 concern 1

- Derived dose of 16 mrem/year to bare skin based on unsupported and unrealistic assumptions, which include:
  - Daily skin contaminations for 250 workdays per year that only persist for 8 hours
  - Implication that after 8 hours, each skin contamination is 100% removed by a standard daily shower
  - Only bare skin is subject to contamination/radiation exposure

OVER-0009 concern 1 resolution

- NIOSH discussed approach for addressing fine particle deposition to satisfaction of SC&A, except for assumptions about the ease with which uranium could be removed from skin and clothing.
- NIOSH prepared a white paper (February 2015), which assessed the literature for articles that qualitatively and quantitatively supported the removal of uranium by washing with soap and water.

OVER-0009 concern 2 and resolution

- **Concern 2:** Concern about the relationship between calculated dose and how IREP uses this dose to derive a POC, given that the skin dose only occurs to a small area.
- **Resolution:** NIOSH did the following:
  - Explained the relationship between derived dose and IREP to determine a POC.
  - Identified specific ORAUT-OTIB-0017 guidance for dealing with nonuniform exposure to the skin.
  - Consulted with SENES to confirm OTIB-0017 guidance was appropriate.

OVER-0009 concern 3 and resolution

- **Concern 3:** Same basic questions as described in concern 1, but for deriving doses for the skin deposition of large uranium flakes.
- **Resolution:** SC&A recommended using OTIB-0017 protocols, where the skin exposure under a hypothetical flake is averaged over the entire surface area of the body.

OVER-0009 Board discussion on daily showers

- **Question:** Are there data to show that all facilities required daily showers, and workers, in fact, took a standard daily shower in winter and summer?
- **Response:** NIOSH stated that it did not look in detail at whether workers took a daily shower. At many facilities, showering was part of their activity, especially operations such as rolling.

OVER-0009 Board discussion on averaging

- **Question:** How is this averaging (i.e., small versus large particles versus whole body) being resolved by IREP?
- **Response:** NIOSH assigns a lognormal distribution to account for various scenarios of how large an area of the skin could have been contaminated.

OVER-0009 Board discussion on location of contamination

- **Question:** We know that a skin cancer occurred on the bare skin. We do not know where the contamination occurred, but we're generating a bare skin estimate and then averaging it over the entire body. Is that claimant favorable?
- **Response:** NIOSH stated that to account for the unknown nature of where the contamination occurred, various lognormal distributions were developed.

Current status of OVER-0009 Board review

- Due to the Board's inability to get all their questions satisfactorily answered, the Board postponed action on approving the review of OVER-0009.
- The Board requested clarification at a future Board meeting.

OVER-0009 followup (August 22, 2018)

NIOSH presentation:

- What is associated risk of assuming a hot particle deposited on a worker's skin was never measured, and you have a skin cancer?
- When you do not know if the skin was irradiated over the tumor or not, it falls into the realm of binomial distribution.
- Since no binomial distribution in IREP, a claimant-favorable lognormal approximation of the binomial distribution was incorporated into OTIB-0017.
- SENES is in process of producing a binomial distribution test model for IREP to determine if lognormal distributions are claimant favorable.

OVER-0009 proposed resolution (August 22, 2018)

- NIOSH is revising OTIB-0017, and a couple of issues are going to be refined for better detail.
- DFO requested SC&A perform a focused review of the revised OTIB-0017.
- Update: OTIB-0017 has not been revised since rev. 01 was issued in 2005.

ORAUT-OTIB-0017, rev. 01

- Title: “Interpretation of Dosimetry Data for Assignment of Shallow Dose”
- Provides guidance for assigning shallow doses to the skin, testes, and breast from nonpenetrating radiation, including exposure to beta and low-energy photons.
- Reviewed by SC&A in June 2006
- Presented to Board April 11, 2018

OTIB-0017 findings 2–5 and resolution

Finding (15 total)	Resolution
Clothing-specific transmission factors should be used	OTIB allows the dose reconstructor to choose the appropriate clothing shielding factors based on minimizing, maximizing, or realistic analysis
Several findings about potential for direct deposition of a hot particle on the worker's skin that is not detected	These findings were transferred to overarching issues (NIOSH-OVER-0009)

OTIB-0017 findings 7–15 and resolution

Finding	Resolution
4 mm clothing thickness not claimant favorable	4 mm assumed for pants and undergarment, not lab coat
Attachment A CF not appropriate for a source near testicles, since film badge would not measure dose	NIOSH said it relies on quality assurance and training to ensure a full array of guidance is correctly employed in DR
OTIB not claimant favorable in instances of unknown factors	OTIB is claimant favorable in recommendations for DCF, LOD, attenuation, and radiation type/energy range

OTIB-0017 Board discussion on finding 12

Question	Response
For finding12, it appears that NIOSH, SC&A, and the Subcommittee are all in agreement, but the revision has been in abeyance since 2007. Is there any indication of when the OTIB will be revised?	NIOSH stated the OTIB is currently undergoing revision for other items, and this finding will be incorporated into the revision that is currently being worked on.

OTIB-0017 Board discussion on finding 7

Question	Response
Finding 7 relates to the 4 mm assumption for clothing and that clothing provides an additional barrier. Since underpants are designed to breath, they cannot be considered impermeable, if that is an assumption implicit in the 4 mm.	NIOSH did not know the answer to the question and would have to do additional research. NIOSH stated that thicknesses were based on VARSKIN guidance.

Current status of OTIB-0017 Board review

- Due to the Board's inability to get all their questions satisfactorily answered, the Board postponed action on approving the review of OTIB-0017.
- The Board requested clarification at a future Board meeting.

OTIB-0017 followup (August 22, 2018)

NIOSH presentation on finding 7:

- NIOSH assessed 3 different sets of clothing and did attenuation measurements for 1–5 mm and a density around 1.5 g/cm^3 for both the undergarments and the protective outer clothing.
- NIOSH re-ran the calculations using the mean of the distribution of the new measured values, resulting in similar values for strontium-90 and yttrium-91.
- For rhodium, ruthenium, rhodium, ruthenium-106, and rhodium-106, the CF results differed by about a factor of 2 (i.e., 0.5, not 0.2)
- NIOSH stated they are in the process of revising OTIB-0017 and will revise table A1 based on their new results.

OTIB-0017 followup Board discussions

Comment	Response
Question on finding 7 was about the permeability of the undergarment, not just the thickness.	NIOSH responded that they are revising OTIB-0017 and will assess the permeability issue during the revision process. Update: OTIB-0017 has not been revised since the issuance of revision 01 in 2005.

Document reviews not included in presentation

- ORAUT-OTIB-0052, rev. 01 and 02, “Parameters to Consider when Processing Claims for Construction Trade Workers”
- OCAS-PER-014, rev. 00, “Construction Trade Workers”
- ORAUT-OTIB-0020, rev. 01, “Use of Coworker Dosimetry Data for External Dose Assignment”