ISSUES RESOLUTION MATRIX FOR ORAUT-OTIB-0017, REVISION 01, "INTERPRETATION OF DOSIMETRY DATA FOR ASSIGNMENT OF SHALLOW DOSE"

Finding Number	Finding Description	NIOSH Response	Finding Resolution
1	**The OTIB needs to provide additional guidance regarding how to interpret film badge data with respect to beta vs. low-energy photon exposure for the purpose of reconstructing shallow doses**. It is suggested that the dose reconstructor check whether the site was reporting dose due to electrons or photons, and whether the dosimetry system had been calibrated for that type of radiation.	**9/25/2007:** DR staff has access to that type of information in the site profile documents and other supporting documentation such as TIBs. For example, an SRS claim would make use of Attachment B to ORAUT-OTIB-0017 (Attachment B, "Skin Dose Assignment for Savannah River Site Cases"), OCAS-TIB-0006 (Section 3, "Shallow Dose Interpretation"), and the site profile document. In addition, there is evidence of over-response of film dosimeters to low-energy photons (as discussed on page 9 of ORAUT-OTIB-0017).	**10/2/2007:** The Subcommittee for Procedure Reviews (SCPR) found NIOSH's response acceptable and closed this finding.
2	**The OTIB assumes that the protective clothing used for each case was known in the majority of cases and the appropriate clothing-specific transmission factors can be selected**.	**10/2/2007:** NIOSH explained that there is language in the OTIB that allows the dose reconstructor to choose the appropriate clothing shielding factors based on whether a minimizing, maximizing, or a realistic analysis of beta dose is being performed. SC&A concurs with this response.	**10/2/2007:** The SCPR found NIOSH's response acceptable and closed this finding.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
3	**It is SC&A's opinion that individual monitoring for beta particles only works on a "yes/no" basis**. The main concern is that a person may experience direct deposition of a hot particle on the skin or localized undetected beta exposure, and it is not detected, and the worker develops skin cancer later in his life. **10/2/2007:** SC&A's main concern is the potential for direct deposition of a hot particle on the worker's skin that is not detected, or localized undetected beta exposure. **10/14/2008:** To improve the dose-to-the-skin reconstruction, the following should be considered: – When the cancer site is on the hands, lower arm or face? Use workplace monitoring data. – When the cancer site is on the thorax? Use individual monitoring data. – When the cancer site is on the lower legs or feet? Use both.	**9/25/2007:** OCAS and ORAUT disagree with this position. Consideration of geometry issues is discussed in the OTIB in the "Exposure Geometry" section, and it is discussed in the DR reports on a case-by-case basis. It is incumbent on the DR staff to analyze and discuss the potential for overestimating or underestimating electron dose with respect to the cancer location. In addition, ORAUT-OTIB-0017 recommends a claimant-favorable dose conversion factor of 1.0 for application of measured electron dose to the skin. **11/7/2007:** NIOSH explained that whether such exposures might have occurred is determined based on frisking data (for hot particles) and knowledge of the working conditions at the facility.	**10/14/2008:** SC&A recommended that Finding 3 be closed, not because everything is resolved, but because OTIB-0017 cannot be improved much further. The SCPR agreed with SC&A's recommendation and closed Finding 3. It should be noted that as a result of findings associated with an SC&A DR review, the skin exposure concern became an overarching issue and was addressed in NIOSH-OVER-0009.
4	**It is possible to state definitely where the cancer site is, but not where the contamination was**.	**9/25/2007:** Other data can be available to DR staff, such as claimant interview information and contamination incident reports. In addition, some work tasks involved partial body irradiation to specific locations of the body that will be apparent to DR staff familiar with the site operations through the use of the site profile and other supporting documentation. In situations where the location of the partial-body exposure is not known, guidance in the section titled "Non-Uniform Exposure of the Skin of OTIB-0017" regarding the development of a lognormal distribution of dose due to potential skin contamination can be used.	**10/2/2007:** Because Finding 4 also relates to the resolution of Finding 3, the SCPR transferred this finding to Finding 3 and closed it according to the resolution of Finding 3.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
5	**A skin dose due to hot particle exposure will not be detected because of the localized nature of the exposure.**	**9/25/2007:** Non-uniform dose can be considered by the DR using the guidance in the OTIB along with tools such as VARSKIN and guidance from site profile documents regarding the potential for hot particle exposure. As shown in the literature (see the Merwin and Moeller reference in the OTIB), hot particle dose can be extremely variable, thus making it difficult to establish a reference hot particle skin dose. If this were possible, codes such as VARSKIN would not exist.	**10/2/2007:** Because Finding 5 also relates to the resolution of Finding 3, the SCPR transferred this finding to Finding 3and closed it according to the resolution of Finding 3.
6	**SC&A questions why an adjustment is needed to an LOD value**. If the dosimeter result was reported as an LOD value, then this value should be used as the basis for the missed dose calculation. **10/2/2007:** There were lengthy discussions about the calibration of dosimeters for low- vs. high-energy photons and what values should be assigned to a worker who was exposed to low-energy photons but the dosimeter was calibrated for high-energy photons. **12/11/2007:** SC&A prepared a white paper on this issue that concluded the following: "*If it is known that the film badge dosimeter overstated the dose from low-energy photons, and if it can be further ascertained that the LOD was expressed in terms of this overstated dose rather than the corrected dose, then we agree that it is appropriate to apply a correction factor to the LOD in assigning a missed dose from low-energy photons*."	**9/25/2007:** An adjustment to LOD is needed for the technical reasons stated in this section (over-response of film to low-energy photons), as specified below: *Although early film dosimeters were relatively accurate for measuring beta doses, they are known to have over-responded significantly to low-energy photons (such as those emitted from plutonium isotopes and daughter products). Although attempts were made at some sites to correct for the over-response through calibration techniques or after-the-fact corrections, it is not always straightforward to reproduce the procedures adopted at the sites.*	**12/11/2007:** Based on SC&A's white paper on OTIB-0017, NIOSH and SC&A concluded that they were in agreement. The SCPR concurred with this resolution and closed Finding 6.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
7	**In Attachment A, "Non-Penetrating Doses to Organs Other Than the Skin," it is not claimant favorable to consider that the employee had 4 mm of clothing thickness over the penis**.	**9/25/2007:** Since the organ discussed in this section is the penis, the 4-mm assumption was made for pants and an undergarment – not a lab coat (although that could have been added), sweater, or shirt. The 4 mm measurement was confirmed a second time for this response.	**10/2/2007:** SC&A and the SCPR found this explanation acceptable, and the SCPR closed Finding 7.
8	**Attachment A provides a correction factor for the breast, penis, and testicle using a source that was modeled as a 10-cm^2 infinitely thin disc source located 2 cm away from the skin. For the breast area, the film dosimeter would give a reasonable dose estimate. However, if the source was near the testicles, the film dosimeter would not measure anything**.	**9/25/2007:** The comment is not relevant to the discussion in this section, which is related to modeling that was performed to determine appropriate correction factors for a range of beta energies. A discussion of dosimeter exposure geometry is provided on page 7 of the OTIB. **10/2/2007:** There was extensive discussion about other documents that address this issue and whether this document should cross-reference those documents. It was agreed that such a cross-referencing would be burdensome, given the evolving nature of the guidance documents. NIOSH explained that it currently relies on QA and training to ensure that the full array of guidance documents are being correctly employed in individual dose reconstructions. NIOSH also pointed out that the workbooks are designed to integrate the guidance contained in multiple documents, which also helps to prevent this problem from arising.	**10/2/2007:** The SCPR concluded that the guidance in the OTIB with respect to this issue is adequate and closed Finding 8.
9	**Tables A-1 and A-2 list correction factors for non-penetrating doses based on radionuclide. However, in nearly all cases, it is not possible to state the radionuclides that are responsible for the beta dose**.	**9/25/2007:** The table provides benchmark correction factors for a range of beta energies. Site profile documents will typically provide information that will help the DR determine the proper energy range to use. In addition, the OTIB itself provides guidance with respect to uranium daughter products.	**11/7/2007:** SC&A and the SCPR agreed with NIOSH's response, and the SCPR closed Finding 9.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
10	**OTIB-0017 states that correction factors for lip dose are most notable for low-energy beta sources with maximum energies <500 keV. However, for low-energy beta radiation, the dosimeters were likely incapable of furnishing accurate doses**.	**9/25/2007:** DR staff would have to consider this on a case-by-case basis. The purpose of the OTIB is to provide general information for the DR staff to use along with other sources of information. If necessary, the hierarchy of data sources listed in IG-001 (Table 1.1) and PROC-0006 (Table 5.2) includes the use of source term modeling.	**11/7/2007:** SC&A and the SCPR agreed with NIOSH's response, and the SCPR closed Finding 10.
11	**It is not clear why the two tables providing examples of skin dose assignments on pages 21 and 24 give the recommendation to assign 30–250 keV for missed dose to the skin for 0 "OW reading" and 0 "S reading."**	**9/25/2007:** This radiation type and energy range was chosen because it is, in fact, claimant favorable compared to assigning the dose as electron dose (see IREP Technical Document).	**11/7/2007:** SC&A and the SCPR agreed with NIOSH's response, and the SCPR closed Finding 11.
12	**The logical order of the information in Chapter 3, "General Approach," could be improved**.	**9/25/2007:** NIOSH agrees with SC&A's finding. OTIB documents are revised for clarity as project time and resources allows. NIOSH will revise OTIB-0017 accordingly in the future.	**11/7/2007:** The SCPR agreed, and the finding was placed In Abeyance until NIOSH has the opportunity to revise the OTIB.
13	**The OTIB does not identify any cases where a possibly high POC can be determined early in the investigation.**	**9/25/2007:** PROC-0006, not OTIB-0017, is the document that would be used by DR staff to quickly triage a claim to determine the potential for high POC. It is important to consider the use of OTIB-0017 in the overall context of the DR process. In addition, OTIB-0017 does give guidance on the topic of low/high POC potential on page 6, items a, b, and c.	**11/7/2007:** SC&A and the SCPR agreed with NIOSH's response. No further action is required, and the SCPR closed Finding 13.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
14	**The OTIB is not claimant favorable in instances of unknown parameters affecting dose estimates**. (Typically, the dosimeter location has no relationship to skin dose at the point of cancer incidence.)	**9/25/2007:** OCAS and ORAUT disagree with this position. Consideration of geometry issues is discussed in the OTIB and is addressed on a case-by-case basis. In addition, the OTIB makes a recommendation (i.e., DCF = 1) to accommodate potential inaccuracies due to exposure geometry. The OTIB is claimant favorable in its recommendations regarding DCF, LOD, attenuation, and radiation type/energy range.	**11/7/2007:** SC&A and the SCPR agreed with NIOSH's response. No further action is required, and the SCPR closed Finding 14.

Finding Number	Finding Description	NIOSH Response	Finding Resolution
15	**The OTIB does not employ scientifically valid protocols for reconstruction of doses:** **(a) Page 6, item 3, of the OTIB states, "*Assign the non-penetrating dose as electrons >15 keV…or photons < 30 keV if the employee worked in a plutonium facility*." Either the dose was originally calculated as being due to electrons for betas or the equivalent calculation was made for photons.** **(b) The assumption of 4 mm thickness of clothing for beta radiation shielding is not claimant favorable.** (c) **The treatment of hot spots is not adequate**.	**9/25/2007**: OCAS and ORAUT disagree with this position. Regarding item (a): The guidance is given in order to assign the non-penetrating dose as electrons or low-energy photons as necessary to complete a valid dose reconstruction using IREP. Dose is often given as "OW" and "S" or "shallow" and "deep" – not beta and gamma (although that condition does occur and DR staff will use that information in their analysis). Regarding item (b): Since the organ discussed in this section of the OTIB is the penis, the 4-mm assumption was made for pants and an undergarment – not a lab coat (although that could have been added), sweater, or shirt as recommended in the general comments section of the SC&A review. The 4-mm measurement for pants and an undergarment was confirmed a second time for this response. The selection of this clothing for this organ is appropriate. Regarding item (c): Non-uniform dose can be considered by the DR using the guidance in the OTIB along with tools such as VARSKIN and guidance from site profile documents regarding the potential for hot particle exposure. Additional information can be gained by analyzing claimant records and interviews.	**11/7/2007**: SC&A and the SCPR agreed with NIOSH's response. No further action is required, and the SCPR closed Finding 15. It should be noted that as a result of findings associated with an SC&A DR review, the non-uniform dose concern became an overarching issue and was addressed in NIOSH-OVER-0009.