



MEMORANDUM

TO: Fernald Work Group
FROM: SC&A, Inc.
DATE: May 18, 2016
SUBJECT: Review of ORAUT-TKBS-0017-4, Revision 03

Introduction and Background

SC&A reviewed the Feed Materials Production Center (FMPC; also referred to as “Fernald”) site profile and delivered its report to the Advisory Board on Radiation and Worker Health (ABRWH or the “Advisory Board”) on November 10, 2006 (SC&A 2006). The site profile is composed of six technical basis documents (TBDs) that, at the time of SC&A’s review, were all dated 2004 or 2006. SC&A’s review of the site profile identified 33 original findings.

In 2014, NIOSH released revised versions of ORAUT-TKBS-0017-2 (site description), ORAUT-TKBS-0017-3 (occupational medical dose), ORAUT-TKBS-0017-4 (occupational environmental dose; also referred to as “TBD-4”), and ORAUT-TKBS-0017-6 (occupational external dose). In December 2015, Revision 03 of ORAUT-TKBS-0017-4, *Feed Materials Production Center – Occupational Environmental Dose* (ORAUT 2015a), was released.

The Fernald issues matrix “Fernald Plant Site Profile Issues Matrix – Draft Preliminary SC&A Assessment,” Revision 4 is the current finding resolution matrix in use by the Fernald Work Group (WG) (SC&A 2016). Revision 4 of the issues matrix reflects finding resolution progress from 21 successive WG meetings held from August 2007 to December 2014, as well as many white papers and memorandum reports related to Special Exposure Cohort (SEC) deliberations of the WG during that period. The issues matrix incorporates several unresolved findings from SC&A’s site profile review and also considers issues that emerged from WG discussions of SC&A’s review of the SEC-00046 evaluation report (ER), which was delivered to the Advisory Board in June 2007 (SC&A 2007). SC&A’s SEC ER review identified 30 original findings, which were eventually merged into six general categories as a result of WG deliberations. Revision 4 of the issues matrix identifies the finding resolution status following the December 2014 WG meeting. There are a total of 12 findings with at least some aspects related to environmental exposure in Revision 4 (Findings 7, 9–11, 22–28, and SEC-3). Prior to the issuance of TBD-4, Revision 03, eight of the findings remained unresolved [open (25, 26), in progress (7, 10, SEC-3) or in abeyance (9, 11, 27)], and four were closed in previous WG meetings (22–24, 28).

SC&A conducted a review of the changes in ORAUT 2015a to determine which of the eight unresolved findings that pertain to environmental exposure could be closed. SC&A determined that three findings could be closed based on the revisions in ORAUT 2015a (Findings 25–27). Five findings (7, 9–11, SEC-3) are applicable to TBD-4 and also ORAUT-TKBS-0017-5, *Technical Basis Document for the Fernald Environmental Management Project (FEMP) – Occupational Internal Dose* (ORAUT 2004; hereafter referred to as “TBD-5”) and cannot be closed until TBD-5 has been revised and reviewed.

NIOSH has developed an auditable Excel workbook, *FMPC Environmental Technical Basis Document Spreadsheets Rev. 03* (ORAUT 2015b), that implements the methodology in ORAUT 2015a. That workbook contains detailed calculations of source terms and environmental transport for assessing environmental exposures for FMPC dose reconstruction. Spot checks of ORAUT 2015b suggest that NIOSH has implemented the updates set forth in ORAUT 2015a in a technically defensible manner. However, SC&A has not been tasked to conduct a detailed review of ORAUT 2015b because validation and verification is deemed to be under the purview of NIOSH.

Review of Revision 03 of TBD-4 (Occupational Environmental Dose)

Table 1 shows the 12 findings SC&A identified as related in some way to TBD-4, Revision 03. For each table entry, the original finding is presented, along with its applicability to reconstruction of environmental doses and the current/recommended status.

Table 1. Findings Related to ORAUT-TKBS-0017-4, Revision 03

Finding	Status in Issues Matrix	Description of Issue and Current Status
7	In Progress	<p><i>Methods for reconstruction and assignment of intakes of thorium-230 (Th-230) associated with raffinate streams in Plant 2/3 that were low in uranium and radium content.</i></p> <p>This issue pertains mainly to the reconstruction of occupational intakes to workers in Plant 2/3 based on available air sampling data (TBD-5). However, the source term constituents from raffinate streams in Plant 2/3 that were present in stack emissions also impact environmental intakes and are therefore pertinent to TBD-4. TBD-4, Revision 03, pp. 32–33 and Section 4.4.2 address the uranium decay product source term as it applies to environmental intakes for the periods 1953–1988 and 1989–2012, respectively. Note that this section is unchanged from TBD-4, Rev. 02 (2014).</p> <p>The issue, as applied to TBD-5, was last discussed during the December 4, 2014, WG meeting and was classified as “in progress” while NIOSH develops methods for assessing occupational internal dose to raffinates (ABRWH 2014b, pp. 128–149).</p> <p><i>Note:</i> Although SC&A believes that the aspects of this finding pertaining to environmental exposure have been adequately addressed, resolution of this issue is still dependent on revision to ORAUT-TKBS-0017-5.</p>

Finding	Status in Issues Matrix	Description of Issue and Current Status
9, 11	In Abeyance	<p><i>Appropriate source term and ratios of trace contaminants [plutonium (Pu), neptunium (Np), and technetium (Tc)] present in recycled uranium for the purposes of assigning intakes during different operational periods at Fernald.</i></p> <p>This issue pertains mainly to the reconstruction of intakes to workers occupationally exposed to recycled uranium (RU) (TBD-5). However, the source term constituents in stack emissions also impact environmental intakes and are therefore pertinent to TBD-4.</p> <p>The issue was last discussed in detail during the February 9, 2012, WG, where the basic method for assessing the main RU contaminants (Pu, Np, and Tc) and that occupational intakes can be bounded were agreed upon (ABRWH 2012, pp. 157–177). The finding was placed in abeyance pending revision to ORAUT-TKBS-0017-5 <u>and</u> ORAUT-TKBS-0017-4.</p> <p>SC&A verified that the RU constituents in Table 4-14 of TBD-4, Rev. 03 contain the agreed-upon RU constituent concentrations for the periods of interest.</p> <p><i>Note:</i> Resolution of this issue is still dependent on revision to ORAUT-TKBS-0017-5.</p>
10	In Progress	<p><i>The radionuclide list for RU in the TBD is incomplete. Furthermore, the concentrations of trace radionuclides in the raffinates, which are much higher than those in the feed material, are not adequately discussed</i></p> <p><i>Remaining unresolved sub-issue: NIOSH to investigate americium-241 (Am-241) in RU or its related waste processing streams and, to develop methods for accounting for Am-241 in dose reconstructions.</i></p> <p>The issue was last discussed during the December 4, 2014, WG meeting, where it was decided that NIOSH needed to address whether Am-241 exposure is feasible and, if so, how to account for it (ABRWH 2014b, pp. 154–167). Table 4-14 of TBD-4, Rev. 03 contain the agreed-upon RU constituent concentrations for the periods of interest. NIOSH has also accounted for Am-241 ingrowth from Pu-241, based on discussions at the December 2014 WG meeting.</p> <p><i>Note:</i> Resolution of this finding is still dependent on incorporation of methods for accounting for Am-241 in TBD-5.</p>

Finding	Status in Issues Matrix	Description of Issue and Current Status
22	Closed	<p><i>The source term for atmospheric uranium emissions from Fernald is significantly underestimated.</i></p> <p>This issue was last discussed during the September 3, 2014, WG meeting, where it was determined that the source term and protocols for reconstructing outdoor exposures were acceptable. The finding was then closed (ABRWH 2014a, p. 165).</p> <p>This issue was closed before the issuance of ORAUT-TKBS-0017-4, Rev. 03.</p>
23	Closed	<p><i>The TBD has not adequately considered various aspects of internal environmental dose, including the applicability of the Gaussian model, episodic releases, and particle size.</i></p> <p>This issue was last discussed during the September 3, 2014, WG meeting, where it was determined that the model does take into consideration the appropriate parameters and uses conservative values. The finding was then closed (ABRWH 2014a, p. 171).</p> <p>This issue was closed before the issuance of ORAUT-TKBS-0017-4, Rev. 03.</p>
24	Closed	<p><i>Diffuse emissions of uranium and thorium may have produced significant internal exposures for some personnel.</i></p> <p>This issue was last discussed during the September 3, 2014, WG meeting, where it was determined that the coworker model discussed for Finding 22 also covers this finding. The finding was then closed (ABRWH 2014a, pp. 177–178).</p> <p>This issue was closed before the issuance of ORAUT-TKBS-0017-4, Rev. 03.</p>
25	Open	<p><i>NIOSH's modeling of radon dose is not claimant favorable and does not take actual working conditions into account.</i></p> <p>This issue was last discussed in great detail during the December 4, 2014, WG meeting, where it was decided that NIOSH would apply the 95th percentile of the modeled doses in ORAUT-RPRT-0052, <i>Feed Material Production Center Internal Dose Topics</i>, Rev. 00 (ORAUT 2011) (ABRWH 2014b, pp. 243–245).</p> <p>Finding can be CLOSED. ORAUT-TKBS-0017-4, Rev. 03 contains revised radon-222 doses using the 95th percentile instead of the median. (See ORAUT 2015b.)</p>

Finding	Status in Issues Matrix	Description of Issue and Current Status
26	Open	<p><i>NIOSH has not considered a major source of radon dose—the storage source of pitchblende ore on site near Plant 1.</i></p> <p>Finding can be CLOSED. This issue is subsumed in Finding 25 and was last discussed during the December 4, 2014, WG meeting. At that meeting, it was decided that NIOSH would apply the 95th percentile of the modeled doses in the RAC report. (ABRWH 2014b, pp. 243–245).</p>
27	In Abeyance	<p><i>The TBD does not consider outdoor diffuse emissions in production areas as a source of external environmental dose.</i></p> <p>The issue was last discussed during the September 3, 2014, WG meeting, where it was agreed that the finding could be closed once NIOSH added specific language to TBD-4 regarding direct deposition on the skin, and that ORAUT-OTIB-0017 procedures are to be directly referenced and implemented in TBD-4 (ABRWH 2014a, pp. 225–229).</p> <p>Finding can be CLOSED. Section 4.1.2 of ORAUT-TKBS-0017-4, Rev. 03 contains the reference to ORAUT OTIB-0017: “Exposures to the skin, including localized doses from direct deposition should be reconstructed in accordance with ORAUT-OTIB-0017, Interpretation of Dosimetry Data for the Assignment of Shallow Dose (ORAUT 2005), and other applicable Project guidance.”</p>
28	Closed	<p><i>External environmental dose for workers near the K-65 silos needs to be better evaluated.</i></p> <p>The issue was last discussed during the September 3, 2014, WG meeting, where it was agreed that the finding could be closed (ABRWH 2014a, pp. 229–240).</p>

Finding	Status in Issues Matrix	Description of Issue and Current Status
Sec-3	In Progress	<p><i>Default concentrations of Pu-239, Np-237, and other isotopes associated with RU at Fernald may not be bounding for some classes of worker activities, buildings, and time periods.</i></p> <p>Related to site profile Findings 9–11. This issue was last discussed during the December 4, 2014, WG meeting, where it was classified as “in progress,” as NIOSH investigated Am-241 in RU or its related waste processing streams and developed methods for accounting for Am-241 in dose reconstructions (ABRWH 2014b, p. 249).</p> <p>Table 4-14 of TBD-4, Rev. 03 contain the agreed-upon RU constituent concentrations for the periods of interest. NIOSH has also accounted for Am-241 ingrowth from Pu-241, based on discussions at the December 2014 WG meeting.</p> <p><i>Note:</i> Closure of this issue is still dependent on revision to ORAUT-TKBS-0017-5.</p>

Conclusion

Based on its review of TBD-4, Revision 03, SC&A has concluded that all applicable findings and issues directly related to the assignment of environmental dose have been satisfactorily addressed in Revision 03 of the occupational environmental dose TBD. However, several of the findings presented in Table 1 remain in progress or in abeyance pending sufficient resolution in the forthcoming revision of TBD-5 (occupational internal dose).

References

ABRWH 2012. Transcript: *Working Group Teleconference, Advisory Board on Radiation and Worker Health, Work Group on Fernald*. February 9, 2012.

ABRWH 2014a. Transcript: *Working Group Meeting, Advisory Board on Radiation and Worker Health, Work Group on Fernald*, held in Cincinnati, Ohio. September 3, 2014.

ABRWH 2014b. Transcript: *Working Group Meeting, Advisory Board on Radiation and Worker Health, Work Group on Fernald*, held in Cincinnati, Ohio. December 4, 2014.

ORAUT 2004. *Technical Basis Document for the Fernald Environmental Management Project (FEMP) – Occupational Internal Dose*, ORAUT-TKBS-0017-7, Revision 00, Oak Ridge Associated Universities. May 28, 2004.

ORAUT 2005. *Interpretation of Dosimetry Data for Assignment of Shallow Dose*, ORAUT-OTIB-0017, Revision 01, Oak Ridge Associated Universities. October 11, 2005.

ORAUT 2011. *Feed Material Production Center Internal Dose Topics*, ORAUT-RPRT-0052, Revision 00, Oak Ridge Associated Universities, July 12, 2011.

ORAUT 2015a. ORAUT-TKBS-0017-4, *Feed Materials Production Center – Occupational Environmental Dose*, Revision 03, December 3, 2015.

ORAUT 2015b. *FMPC Environmental Technical Basis Document Spreadsheets Rev. 03 1951–1988*, ORAUT-TKBS-0014-4, Oak Ridge Associate Universities Team. August 11, 2015. [SRDB Ref. ID 146700]

SC&A 2006. *Review of the NIOSH Site Profile for the Fernald Environmental Management Project (Feed Materials Production Center)*, SCA-TR-TASK1-0010. November 2006.

SC&A 2007. *Review of the Feed Materials Production Center (FMPC) Special Exposure Cohort (SEC) Petition-00046 and the NIOSH SEC Petition Evaluation Report*, SCA-SEC-TASK5-0056, Revision 1. June 2007.

SC&A 2016. *Fernald Plant Site Profile Issues Matrix – Draft Preliminary SC&A Assessment*, SCA-SP-IM2013-0045, Revision 4. May 2016.