

 **Memorandum**

To: Subcommittee for Procedure Reviews
From: SC&A, Inc.
Date: April 28, 2021
Subject: Focused Review of ORAUT-OTIB-0066, Revision 01, for Resolution of Issues

Introduction

At the February 18, 2021, meeting of the Subcommittee for Procedure Reviews (SCPR), the Advisory Board on Radiation and Worker Health tasked SC&A to perform a focused review of ORAUT-OTIB-0066, revision 01, “Calculation of Dose from Intakes of Special Tritium Compounds” (NIOSH, 2020; hereafter “OTIB-0066”), dated October 15, 2020. The purpose of this focused review was to determine if the National Institute for Occupational Safety and Health (NIOSH) addressed and resolved the issues raised in SC&A’s (2008) review of revision 00 of ORAUT-OTIB-0066 (NIOSH, 2007).

The following documents are central to this review:

- ORAUT-OTIB-0066, revision 00, April 26, 2007 (NIOSH, 2007)
- SCA-TR-TASK3-0010, revision 00, “Review of ORAUT-OTIB-0066, Calculation of Dose from Intakes of Special Tritium Compounds,” November 25, 2008 (SC&A, 2008)
- ORAUT-OTIB-0066, revision 01 (NIOSH, 2020)

This memorandum reports on the results of SC&A’s focused review of OTIB-0066, revision 01 (NIOSH, 2020).

Background

Section 2.0 of OTIB-0066 (NIOSH, 2020, p. 5) summarizes the issue that it is intended to address:

Stable metal tritides (SMTs) are a class of tritium compounds that cannot be detected by urine bioassay as easily as tritium oxide. “Stable” is used to indicate that the tritium is not easily separated from the metal matrix in which it is bound. The material is more strongly retained in the lung, resulting in much smaller fractions of the intake excreted in urine. Therefore, a relatively small amount of tritium in a urine sample can indicate a large intake of an SMT. Ideally, workplace information, in the form of air monitoring, surface contamination

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activity, and process knowledge, are used to assign potential intakes of this material, which is addressed in a site profile when possible.

In the absence of other available monitoring data, urinalysis can be used to provide a best estimate of an intake. The purpose of this TIB is to provide guidance on how to use urine bioassay data to calculate best estimates of the annual organ doses for intakes of tritium in a metal matrix.

Evaluation of Resolution of Findings

SC&A's (2008) evaluation of revision 00 of OTIB-0066 had four findings. After discussions among the participants and per SC&A's recommendations at the March 24, 2009, SCPR meeting, the Subcommittee placed findings 1 and 3 in abeyance and closed findings 2 and 4. The status each finding is currently reflected in their Board Review System (BRS) entries. This review discusses the two findings that are in abeyance.

Finding 1 (listed as issue 3 in SC&A, 2008):

The recommendation given in ORAUT-OTIB-0066 to assess dose due to intake of OBT [organically bound tritium] is not claimant favorable. The OTIB recommends the use of the methodology given in ORAUT-OTIB-0011 [NIOSH, 2004] to calculate doses from intakes of OBT to all organs and tissues. The dose coefficient for OBT given in ICRP Publication 78 (ICRP 1997), which is 1.52×10^{-7} mrem/pCi (see Table 3); the one derived applying the biokinetic model for OBT (ICRP, 1989; ICRP, 1993; ICRP, 1995; and ICRP, 1997) using the AIDE computer code, which is 1.52×10^{-7} mrem/pCi (see Table 3); and the one derived using the methodology given in ORAUT-OTIB-0066 ([NIOSH, 2007]), which is also 1.52×10^{-7} mrem/pCi (see Table 2), are 1.4 times higher than the one obtained applying the methodology given in ORAUT-OTIB-0011 ([NIOSH, 2004]), which is 1.08×10^{-7} mrem/pCi. [SC&A, 2008, p. 16]

NIOSH responded in its BRS entry of January 23, 2009:

The reviewer is correct. The factor of 1.4 is correct for a Type 1 calculation on the urinary excretion during a chronic intake, but the adjustment is somewhat larger for Type 2 and Type 3 calculations. The algorithm used in ORAUT-OTIB-0011 can be modified to provide a claimant favorable dose from intakes of pure organically bound tritium (OBT), i.e., it is not necessary to use IMBA [Integrated Modules for Bioassay Analysis] in this case. ORAUT-OTIB-0011 will be revised to incorporate these changes.

The most recent NIOSH BRS entry, dated October 21, 2020, states:

The recommendation to use the methodology given in ORAUT-OTIB-0011 to calculate doses from intakes of OBT to all organs and tissues has been removed in Rev. 01 of this document. It now specifies that IMBA must be used for such an assessment.

SC&A compared the two versions of OTIB-0066 to identify changes relevant to finding 1 and noted that NIOSH modified recommendation 2 (Section 5.0) and added a new Recommendation 3, increasing the number of recommendations from five to six. The relevant recommendations in revision 01 of OTIB-0066 now read as follows:

- **Recommendation 2:** “The method in ORAUT-OTIB-0011 . . . can be used without modification to calculate doses from intakes of HTO [tritiated water] to all organs and tissues” (NIOSH, 2020, p. 10). Revision 00 included “and OBT” after “HTO.”
- **Recommendation 3:** “Because the ORAUT-OTIB-0011 . . . method underestimates the dose from an OBT intake by about 30%, it cannot be used for assessment of OBT. IMBA must be used for intake assessments when based on urine bioassay and IMBA or Web CAD used for dose assessment” (NIOSH, 2020, p. 10).

SC&A believes that revision 01 of OTIB-066 adequately addresses the concerns of finding 1 and recommends that its status be changed to closed.

Finding 3 (listed as issue 5 in SC&A, 2008):

OTIB-0066 does not ensure that resultant doses are based on adequate monitoring data. . . .

The method of choice for personnel monitoring is particulate air monitoring; however, there are multiple issues with the use of these data. [SC&A, 2008, p. 18]

NIOSH responded in its BRS entry of January 23, 2009:

NIOSH agrees that air monitoring data are useful for evaluating intakes of stable metal tritides (SMT) (and most other radioactive materials). However, in the absence of such data, urine bioassay can be used to bound the SMT intake and subsequent dose to the respiratory tract and systemic organs.

A discussion of the practical interpretation of urinalysis results following an intake of SMT and the technical shortfalls associated with using urine bioassay data might be useful to the dose reconstructors and therefore will be added to ORAUT-OTIB-0066.

The most recent NIOSH BRS entry, dated October 21, 2020, states, “A paragraph was added to the Purpose section of Rev. 01 of this document that discusses the limitations associated with the use of urine sampling for quantifying SMT intakes.”

Section 2.0, “Purpose,” of OTIB-0066, revision 01, which is quoted in full in the “Background” section of this memorandum, is a substantial expansion of the original section in revision 00, which only stated:

The purpose of this TIB is to provide guidance on how to use urine bioassay data to calculate the best estimates of the annual organ doses for intakes of tritium

bound to organic compounds (organically bound tritium; OBT) and tritium in a metal matrix (stable metal tritide; SMT). [NIOSH, 2007, p. 5]

SC&A believes that revision 01 of OTIB-0066 adequately addresses the concerns of finding 3 and recommends that its status be changed to closed.

Summary and Conclusions

SC&A performed a focused review of ORAUT-OTIB-0066, revision 01 (NIOSH, 2020), to determine if the current revision addresses and resolves the two “in abeyance” findings (1 and 3) from SC&A’s (2008) review of revision 00 (NIOSH, 2007). SC&A concludes that both findings have been adequately addressed and resolved and recommends closure.

References

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