Battelle Technical Information Bulletin - 5000

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Overview

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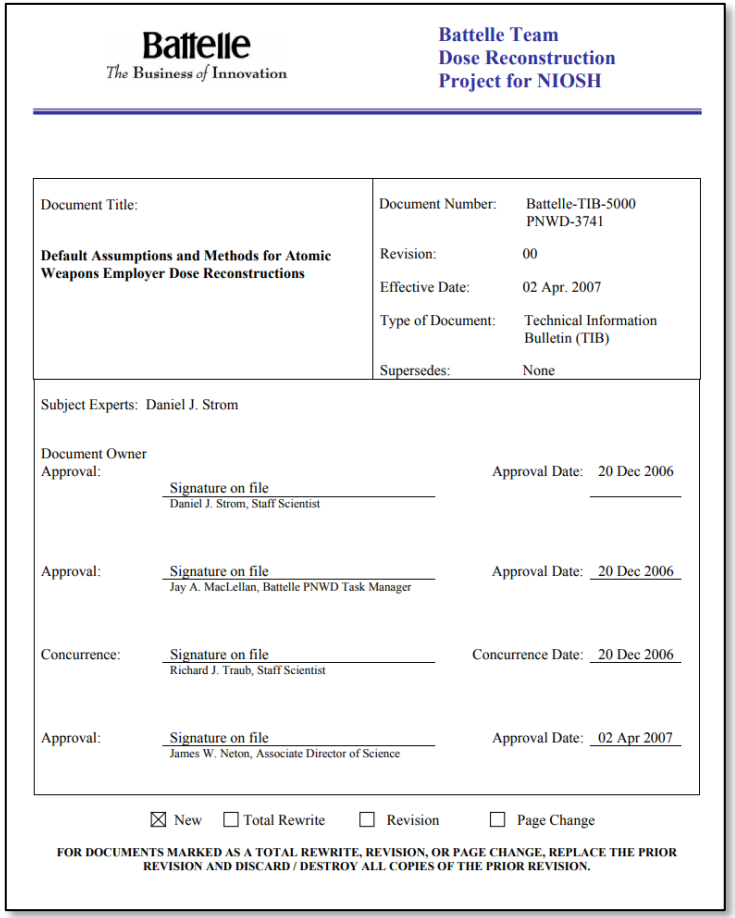

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Battelle Team
Dose Reconstruction
Project for NIOSH

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Default Assumptions and Methods for Atomic Weapons Employer Dose Reconstructions	Revision:	00
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Subject Experts: Daniel J. Strom

Document Owner Approval: Signature on file — Daniel J. Strom, Staff Scientist — Approval Date: 20 Dec 2006

Approval: Signature on file — Jay A. MacLellan, Battelle PNWD Task Manager — Approval Date: 20 Dec 2006

Concurrence: Signature on file — Richard J. Traub, Staff Scientist — Concurrence Date: 20 Dec 2006

Approval: Signature on file — James W. Neton, Associate Director of Science — Approval Date: 02 Apr 2007

☒ New ☐ Total Rewrite ☐ Revision ☐ Page Change

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Brief History of BTIB-5000

History of BTIB-5000

https://www.cdc.gov/niosh/ocas/pdfs/tibs/b-t5000-r0.pdf

- March 2007: Battelle-TIB-5000, Rev. 00 “Default Assumptions and Methods for Atomic Weapons Employer Dose Reconstructions”
- March 2021: Subcommittee for Procedure Review (SCPR) tasked SC&A to review BTIB-5000.
- January 2022: SC&A submits review to NIOSH
  - 13 Observations & 0 Findings
- August 2022: NIOSH provides responses to SCPR

SC&A Comments on BTIB-5000

SC&A Observation 1

Battelle-TIB-5000 makes extensive use of the computer program LOGNORM4, which is no longer publicly available.

NIOSH Response:

NIOSH concurs that LOGNORM4 is no longer being used. Currently, NIOSH employs a variety of freeware statistical programs (e.g., R-code) or commercial Excel add-ins (e.g., Vose and @Risk) for dose reconstruction tools and to perform various statistical analysis of datasets.

SC&A Observation 2

There are more modern methods for treating censored data.

NIOSH Response:

NIOSH concurs that there are more modern methods for treating censored data.

- Regression on order statistics is discussed in ORAUT-RPRT-0053, "*Analysis of Stratified Coworker Datasets*",
- Multiple imputation is discussed in ORAUT-RPRT-0071, "*External Dose Coworker Methodology*", and ORAUT-RPRT-0096, "*Multiple Imputation Applied to Bioassay Co-Exposure Models*".

The methods, as described in Battelle-TIB-5000, Section 2.1.3, are not currently being used.

SC&A Observation 3

The number of observations in the highest airborne uranium concentration group in 1949 is stated to be 64 by Battelle-TIB-5000, section 2.1.4.1. This value is inconsistent with the value of 61 shown in TIB-5000, table 2.4, and with the 119 total observations in 1949 listed by TIB-5000.

NIOSH Response:

NIOSH agrees that 61 is most likely the correct number for the fourth data point, as noted in the SC&A review, this observation did not alter any conclusions in the TIB.

SC&A Observation 4

The mirror image and preserved mean and variance methods are not supported by any technical background in statistical theory of which we are aware.

NIOSH Response:

NIOSH concurs that there are more modern methods for assessing data. A more modern method to handle the sum of normal noise and lognormal signal is the normal-lognormal mixture distribution. It is described in ORAUT-RPRT-0096, Multiple Imputation Applied to Bioassay Co-Exposure Models. The methods, as described in Battelle-TIB-5000, Section 2.3.1, are not currently being used.

SC&A Observation 5

Battelle-TIB-5000 lacks a sound basis for asserting that the NCRP assessment of the reliability of the ICRP Publication 30 models can be applied to the currently used ICRP Publication 66 respiratory tract and biokinetic models.

NIOSH Response:

NIOSH is currently addressing this observation. We will include it in a separate report.

SC&A Observation 6

A GSD of 10, derived from redundant data across seven uranium refining plants, is excessive for a sitewide assessment of an individual worker.

NIOSH Response:

NIOSH concurs that the use of a GSD of 10 for an entire site, plant, or factory might be excessive. A GSD of 10 as described in Battelle-TIB-5000, Section 3.6, is not currently being used. As noted in the SC&A comments, NIOSH is using a GSD of 5 as the default value in DRs when no other uncertainty data are available. A minimum GSD of 3 is often used for biokinetic modelling.

SC&A Observation 7

Dividing the operation - “removing covers from drums” - that was observed to take 24 minutes per shift, into two 12-minute periods, characterized by low and high radon concentrations, respectively, is arbitrary and not claimant favorable.

NIOSH Response:

NIOSH concurs that there are better statistical methods for consolidating data into a statistic to be used for dose reconstruction. NIOSH does not employ the results of the time-weighted average example in Battelle-TIB-5000, Section 3.8 for dose reconstructions at Lake Ontario Ordinance Works (LOOW).

SC&A Observation 8

The procedure for assessing inadvertent ingestion for residual periods at AWE sites has been updated since the issuance of TIB-5000.

NIOSH Response:

NIOSH concurs that the use of OCAS-TIB-009, Estimation of Ingestion Intakes, to assess inadvertent ingestion during an AWE site's residual period is not appropriate. During an AWE site's residual period, NIOSH is currently standardizing our approach to be consistent with NUREG/CR-6755 which is based upon NUREG/CR-5512 (1992) Volume 1. Section 6.3.2 for guidance on inadvertent ingestion.

SC&A Observation 9

The revised guidance on dose reconstruction from occupational medical x-ray procedures (ORAUT-OTIB-0006, revision 05) should be used for the assessments of external doses from such procedures.

NIOSH Response:

NIOSH concurs and is using the current version of ORAUT-OTIB-0006 when performing current the dose reconstructions.

SC&A Observation 10

Missed doses should be assigned according to the current procedures: OCAS-IG-001, revision 3, and ORAUT-OTIB-0020, revision 03. Assigning a triangular distribution with minimum = 0, mode = 0.5 × LOD, and maximum = LOD is not consistent with current guidance.

NIOSH Response:

NIOSH agrees that external missed dose should not be assigned using a triangular distribution. Guidance associated with assignment of external missed dose is covered in OCAS-IG-001, External Dose Reconstruction Implementation Guideline and ORAUT-OTIB-0020, Use of Coworker Dosimetry Data for External Dose Assignment. The method described in Battelle-TIB-5000, Section 3.14, is not currently being used.

SC&A Observation 11

Ingestion should be added to the pathways of environmental doses.

NIOSH Response:

NIOSH agrees that ingestion is a possible pathway of environmental intakes and should be considered when developing an environmental exposure approach. ORAUT-PROC-0031, Site Profile and Technical Basis Document Development, Section 6.7.3., call for the ingestion pathway to be evaluated if it is applicable to the site.

SC&A Observation 12

Using a lognormal distribution with a mean value of 0.02 to represent an equilibrium factor for thoron is questionable. A bounding, site-specific equilibrium factor should be derived as needed, based on available data.

NIOSH Response:

The equilibrium factor, as described in Battelle-TIB-5000, Section 3.17.3, is not currently being used. Guidance associated with the thoron equilibrium factor is provided in DCAS-TIB-011, Dose Conversion Factors for Radon WLM.

SC&A Observation 13

Even if the true underlying distribution of concentrations were lognormal, there is no real reason to assume that the distribution of the uncertainty of the representativeness parameter is also lognormal.

NIOSH Response:

NIOSH concurs that there are more modern methods for dealing with uncertainty distribution. This method, as described in Battelle-TIB-5000, Section 3.20, is not currently being used.

Next Steps

- NIOSH is developing a separate report to address the use of a Geometric Standard Deviation (GSD) of 3.0 for uncertainty in biokinetic modelling.
  - It will be the response to Observation #5.
  - The use of GSD of 3.0 may be the only part of BTIB-5000 that is currently being used in dose reconstructions.
- NIOSH is currently assessing the role Battelle-TIB-5000 may have on other programmatic documents that provide guidance on dose reconstructions. Once complete, NIOSH will consider cancelling this document.

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Questions?

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