



# A Review of ORAUT-TKBS-0003-7 for Savannah River Site: Internal Dosimetry Co-exposure Data

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# ORAUT-TKBS-0003-7 – Prior documents

- ◆ March, 13, 2019: NIOSH issued ORAUT-OTIB-0081, rev. 04 (OTIB-0081)
- ◆ March 13, 2020: SC&A issued rev. 1 of review of OTIB-0081
- ◆ June 3, 2020: SC&A issued memorandum, “Summary Position on Trivalent Bioassay Variability,” to the Savannah River Site (SRS) and Special Exposure Cohort (SEC) Issues work groups (WGs)
- ◆ November 20, 2020: Transcript of joint teleconference meeting of Advisory Board on Radiation and Worker Health (ABRWH) SRS and SEC Issues WGs
- ◆ April 21, 2022: SC&A issued memorandum, “SRS Trivalent Bioassay Variability Status and Recommendation,” to the SRS and SEC Issues WGs
- ◆ March 5, 2024: NIOSH issued ORAUT-TKBS-0003-7, rev. 00 (TBD-7)

# SC&A review of OTIB-0081

2020: Identified five findings and eight observations

- All findings and observations addressed and closed except finding 1

- ◆ Finding 1 concerned with variability in trivalent bioassay results

- Was further reviewed by SC&A in 2020 and 2022

- Addressed by NIOSH in TBD-7, attachment C

# SC&A evaluation of finding 1

- ◆ SC&A evaluated NIOSH's further analysis of variability in trivalent bioassay results in TBD-7, attachment C
  - Does not find variability of alpha particle counting results from several bioassay samples for americium would significantly impact derived co-exposure (CE) americium intake rates for dose reconstruction (DR)
  - Recommends closure of finding 1 of SC&A's 2020 review of OTIB-0081

# SC&A approach to review of TBD-7

- ◆ Had reviewed OTIB-0081
- ◆ Reviewed TBD-7 to identify revisions incorporated into TBD-7 compared to OTIB-0081
- ◆ Focused on revisions that could potentially impact internal dose assignments in a claimant's DR

# Major revisions

- ◆ SC&A identified the following revisions that could increase internal DR dose assignments
  - Americium
    - Updated and reentered americium bioassay data
    - Revised urinary excretion rates
    - Revised CE intake rates
  - Thorium
    - Revised CE intake rates using updated and reentered americium bioassay data
  - Plutonium
    - Derived plutonium absorption type super S (SS) CE intake rates

# NIOSH updated and reentered americium bioassay data

- ◆ NIOSH performed the following steps to remodel americium bioassay data:
  - Updated and reentered americium urinalysis data
  - Used time-weighted one person–one statistic method
  - Used multiple imputation method

# SC&A review of updated and reentered americium bioassay data

- ◆ Reviewed revised americium bioassay data
- ◆ Did not identify any findings or observations

# NIOSH revised urinary excretion rates

- ◆ NIOSH used the remodel americium bioassay data to derive revised urinary excretion rates
  - 50th and 84th percentile
  - Geometric standard deviation (GSD)
  - For non-construction trade workers (nonCTWs) and CTWs
  - Covering years 1963–1989
- ◆ Table 7-6 presents summary of revised americium (Am-241) urinary excretion rates

# SC&A review of revised urinary excretion rates

- ◆ Reviewed NIOSH's reanalysis of revised americium bioassay data
  - Referred documents
  - NIOSH's spreadsheets contained in "Support Files for ORAUT-TKBS-0003-7, Rev. 00 Zip File"
- ◆ Did not identify any findings or observations concerning data analysis methods or Am-241 urinary excretion rates in table 7-6

# NIOSH revised CE intake rates

- ◆ Used revised urinary excretion rates to derive nonCTWs and CTWs Am-241 type M intake rates
  - Grouped table 7-6 urinary excretion rates into intake regimes (IRs) of similar excretion rates
  - Used IMBA program to derive projected 50th and 95th percentile intake rates and GSD values
  - Summarized results in table 7-19 for nonCTWs and table 7-20 for CTWs
  - Projected Am-241 50th, 84th, and 95th percentile intake rates; GSD; and adjusted GSD listed in table E-1 for nonCTWs and table E-2 for CTWs

# SC&A review of revised CE intake rates

- ◆ Checked representative portion of NIOSH's IMBA runs
- ◆ Verified correct bioassay data entries, selection of IRs, and projected intake rates
- ◆ Reviewed IMBA plots of measured bioassay data and fitted bioassay data in each IR of interest
- ◆ Found fits between actual bioassay data and projected bioassay data derived from CE intake modeling reasonably consistent
- ◆ Did not identify any findings or observations concerning recommended Am-241 type M intake rates in tables 7-19, 7-20, E-1, and E-2

# NIOSH revised CE thorium intake rates

- ◆ During radiochemical separation for trivalent radionuclides, thorium is carried over in aliquot containing americium, curium, and californium
- ◆ Chemical extraction efficiency for thorium (97%) is approximately same as for americium (95%)
- ◆ If possibility of thorium in bioassay sample, thorium intake can be analyzed using americium urinary excretion rate data
- ◆ NIOSH used americium urinary excretion rate data from table 7-6 in IMBA to derive potential thorium (Th)-232 type M and type S nonCTW and CTW CE intake rates
- ◆ Results in tables 7-43, 7-44, E-25, and E-26 for November 1, 1972, through May 31, 1980

# SC&A review of revised CE thorium intake rates

- ◆ Focused review of subset of thorium IMBA runs NIOSH provided in zip file
  - Verified correct bioassay data entries, selection of IRs, and projected intake rates
  - Reviewed IMBA plots of measured bioassay data and fitted bioassay data in each IR of interest
  - Found fits between actual bioassay data and projected bioassay data derived from CE intakes to be reasonably consistent
  - Did not identify any findings concerning recommended Th-232 type M or type S intake rates listed in tables 7-43, 7-44, E-25, and E-26
- ◆ Had four observations (slides 15–18)

# Observation 1: Thorium intake start dates in tables appear to be incorrect

- ◆ SRS SEC included lack of sufficient internal thorium monitoring data ending September 30, 1972
- ◆ OTIB-0081, tables 5-23 and 5-24, list start date for thorium as October 1, 1972
- ◆ However, thorium intake start date in tables 7-43, 7-44, E-25, and E-26 of TBD-7 is listed as November 1, 1972

## Observation 2: NIOSH used thorium intake rates from ORAUT-RPRT-0070 instead of derived from americium bioassay data

- ◆ Table 7-6 provides CE americium excretion rates for 1963–1989
- ◆ NIOSH only used these data to derive thorium intake rates for 1972–1980
- ◆ NIOSH used ORAUT-RPRT-0070 intake recommendations for 1980–1989
- ◆ TBD-7 does not state why this change was made

# Observation 3: Thorium ingestion intake rates not addressed for 1972–1980

- ◆ Ingestion of radionuclides are associated with inhalation intake per OCAS-TIB-009
- ◆ Ingestion intake rates not listed in tables 7-43 and 7-44 for 1972–1980 as they were for 1980–1989

# Observation 4: Thorium intake rates in tables appear to be incomplete

- ◆ Tables 7-43 and 7-44 both list thorium intake rates for two periods
  - 1972–1980 (inhalation derived from americium bioassay data)
  - 1980–1989 (inhalation and ingestion intake rates from ORAUT-RPRT-0070)
- ◆ Tables E-25 and E-26 only list thorium inhalation intake rates for 1972–1980 and no ingestion intake rates

# NIOSH derived plutonium absorption type SS CE intake rates

- ◆ Used plutonium urinary excretion rate data from table 7-8
- ◆ Derived type SS plutonium intake rates for nonCTWs and CTWs, in addition to previous intake rates derived for types M and S
- ◆ Did not add or revise new plutonium bioassay data; table 7-8 same as table 4-4 of OTIB-0081
- ◆ Grouped urinary excretion rates from table 7-8 into IRs of similar excretion rates
- ◆ Used Internal Dosimetry Tool (IDOT) to derive projected 50th and 95th percentile intake rates for nonCTWs and CTWs for 1955–1990 and GSD values
- ◆ Summarized in table 7-24
- ◆ Projected plutonium 50th, 84th, and 95th percentile intake rates and GSD values listed in table E-5 for nonCTWs and table E-8 for CTWs

# SC&A review of plutonium absorption type SS CE intake rates

- ◆ Focused review of subset of IDOT runs provided by NIOSH in zip file
  - Verified correct bioassay data entries, selection of IRs, and projected intake rates
  - Reviewed IDOT plots of bioassay data and projected bioassay values
  - Found reasonable fits between observed and projected urinalysis results
  - Did not identify any findings or observations concerning recommended plutonium type SS intake rates listed in tables 7-24, E-5, and E-8
- ◆ However, SC&A did have an observation concerning NIOSH's use of plutonium data in general

# Observation 5: Plutonium data may have needed recoding

- ◆ No plutonium urinalysis data were added or revised, but SC&A notes that the original plutonium urinalysis datasheets were in a nearly identical format, and often on the same page as americium urinalysis sheets that required recoding
- ◆ This could indicate that plutonium data also needed to be recoded

# SC&A review of TBD-7 methods and documentation

- ◆ Had previously reviewed NIOSH's methods used to derive CE intake rates in OTIB-0081
- ◆ TBD-7 contained same analysis NIOSH used for OTIB-0081, plus some expanded analysis for quality assurance in attachment A
- ◆ Reviewed additions and revised quality assurance analysis in attachment A
- ◆ Found results indicated improved or identical data transcription and worker classification acceptable error rates for in vitro and in vivo bioassays
- ◆ Did not identify any findings or observations concerning NIOSH's analytical methods or results

# SC&A review of documentation – Table contents and text

Detailed review of TBD-7 identified four observations (slides 24–27)

# Observation 6: Change in table 7-7 tritium dose GSD

- ◆ Some tritium annual dose GSD values for nonCTWs and CTWs in table 7-7 of TBD-7 are different from entries in table 4-3 of OTIB-0081, while all other values remained the same
- ◆ There was no indication that tritium was reevaluated for TBD-7

## Observation 7: Some table 7-16 entries need clarification

NonCTW GSD values (column 4) in table 7-16 of TBD-7 for 1977–1989 for neptunium contain values that are shifted one row down from corresponding years compared to entries in table 4-12 of OTIB-0081.

# Observation 8: Some table 7-34 entries need clarification

- ◆ Table 7-34 of TBD-7 for 1961–1969 contains values that appear to have been switched in columns 3 and 4 from those listed in table 5-15 of OTIB-0081
- ◆ While all uranium intake rates in the tables remain the same in TBD-7 compared to OTIB-0081, intake rates in column 4 of table 7-34 of TBD-7 are slightly less than corresponding values in column 3 of OTIB-0081, but there is no indication uranium data were reevaluated for TBD-7

## Observation 9: Incorrect text on page 142

- ◆ Attachment A states: “There are no issues with the transcription error rates in this SRS tritium dataset.”
- ◆ However, it should read: “There are no issues with the transcription error rates in this SRS neptunium dataset,” since it is an evaluation of **neptunium** data, **not tritium**.

# SC&A evaluation of NIOSH's commitments to modify SRS guidance

- ◆ Identified resolution of issues in 66 previously completed DR case reviews
- ◆ Searched for NIOSH's commitments to change SRS TBD to resolve issues
- ◆ Evaluation did not identify any commitments by NIOSH to change SRS TBD that would impact guidance in newly issued TBD-7

# Summary of SC&A review of TBD-7

- ◆ Reviewed TBD-7 and evaluated NIOSH's methodology and recommended intake rates. Focused on major revisions that could impact DR.
- ◆ SC&A identified no findings but did have nine observations:
  - **Observation 1:** Thorium intake start dates in tables 7-43, 7-44, E-25, and E-26 appear to be incorrect
  - **Observation 2:** NIOSH used thorium intake rates from ORAUT-RPRT-0070 instead of derived from americium bioassay data
  - **Observation 3:** Thorium ingestion intake rates not addressed for 1972–1980
  - **Observation 4:** Thorium intake rates in tables E-25 and E-26 appear to be incomplete
  - **Observation 5:** Plutonium data may have needed recoding
  - **Observation 6:** Change in table 7-7 tritium dose GSD
  - **Observation 7:** Some table 7-16 entries need clarification
  - **Observation 8:** Some table 7-34 entries need clarification
  - **Observation 9:** Incorrect text on page 142



# Questions ?