

# **NIOSH Response to SC&A Review of RPRT-0070 Methods for Th-232 Dose Reconstructions**

**Response Paper**

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**National Institute for Occupational Safety and Health**

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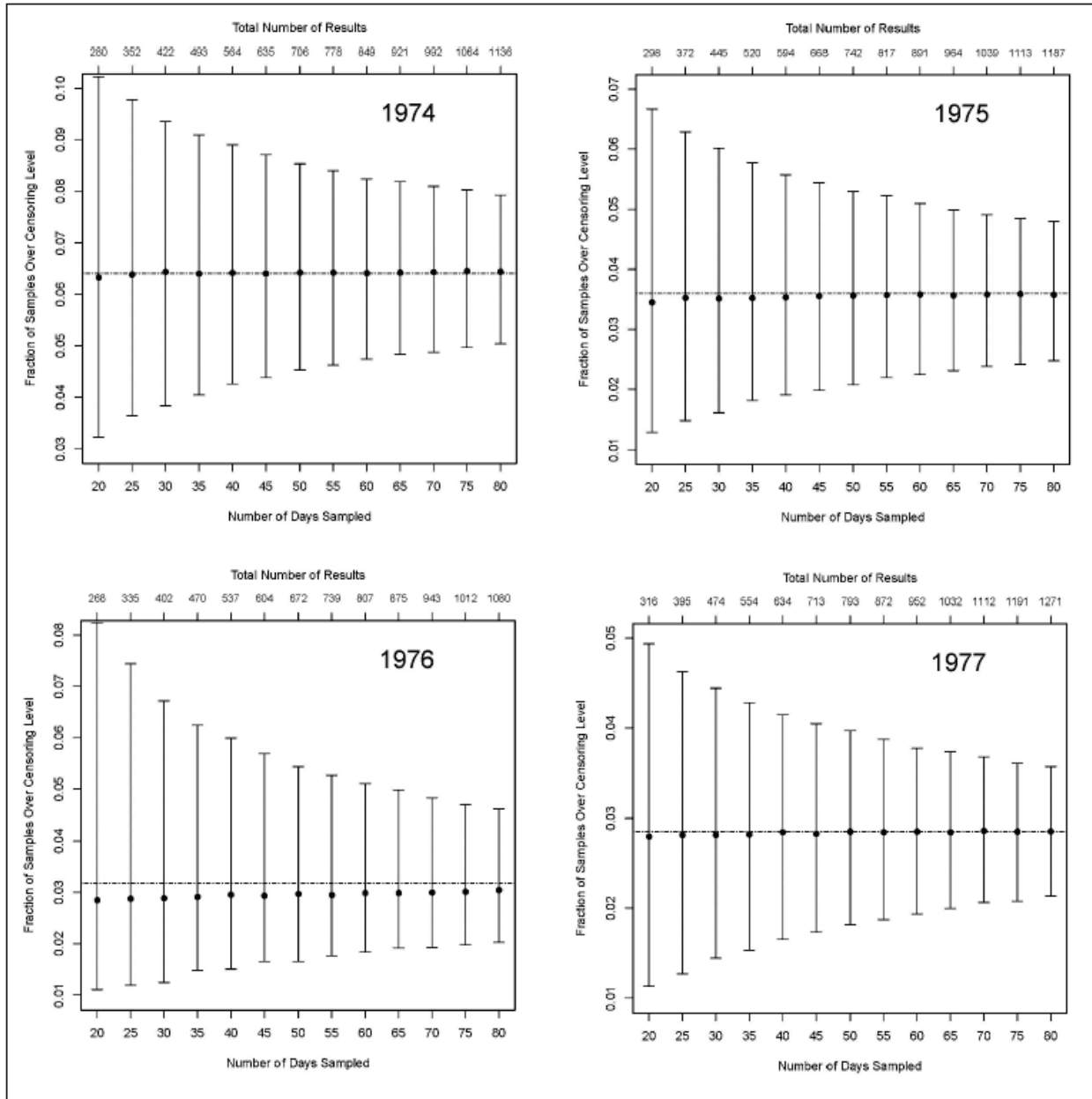
## **INTRODUCTION**

In 2017, the ORAU Team issued ORAUT-RPRT-0070, *Evaluation of Method for Assessment of Thorium-232 Exposures at the Savannah River Site from 1972 to 1989* (ORAUT 2017). This is an assessment of methods to bound thorium doses at Savannah River Site (SRS) from 1972 through 1989. In response to ORAUT 2017, SC&A issued *SC&A Review of RPRT-0070 Methods for Th-232 Dose Reconstruction* (SC&A 2018). In this document, the ORAU Team responds to four observations and one finding recorded by SC&A in their review of ORAUT-RPRT-0070 methods

## **NIOSH RESPONSES TO SC&A COMMENTS**

**SC&A Observation 1:** *The methods used in selecting an appropriate sample size for analysis were based on air sampling data from a separate facility during a separate timeframe. NIOSH should provide a discussion in RPRT-0070 to demonstrate that the statistical analysis of gross alpha air sampling in Building 235-F during the 1970s is sufficiently analogous of the conditions in the 773-A Laboratory Areas during the 1980s to justify its use in defining a random sample size for exposure potential analysis to thorium (1981–1989).*

**NIOSH Response:** Air monitoring data from 235-F were only used to model the minimum number of results needed to provide acceptable confidence in the determination that the limit was considered bounding. The model gave the number of air samples needed per year as 750. As discussed in Section 3.2 and Figure 3-1 of ORAUT-RPRT-0070, this number was determined by visually identifying the point on all of the plots, using the top x-axis (number of results), at which there is little change in the sample median (ORAUT 2017). Figure 1 below provides Figure 3-1 from ORAUT 2017 for the reader's convenience. The same air monitoring procedures and techniques used in 773-A were used in 235-F and both sampled for gross alpha contamination. Air concentration data from 235-F were not used to represent air contamination in Building 773-A or to serve as surrogate for Building 773-A.



Source: ORAUT 2017, Figure 3-1

**Figure 1. Fraction of Sample Results Expected Over the Censoring Level (censoring level for this dataset = 0.1 DAC).**

**SC&A Observation 2:** *Because the air sampling methodology only applies to the period after May 1980 (or alternately December 1980), it is not clear why NIOSH chose to analyze air sampling data during the year 1975 as shown in Figure 3-2 of RPRT-0070. Inclusion of such data is likely inappropriate.*

**NIOSH Response:** Given that this approach is limited to the time period of 1980 through 1989, NIOSH agrees that 1975 should not have been included in the analysis. However, given that the limiting air concentration was the censoring level for all years, the exclusion of 1975 does not impact this methodology.

**SC&A Observation 3:** *Given that the cited air sample references only report the values that were above the CL ( $1 \times 10^{-12}$   $\mu\text{Ci}/\text{cm}^3$ ), SC&A requests clarification of how the total number of samples (i.e., the denominator) was determined as presented in Figure 3-2 of RPRT-0070.*

**NIOSH Response:** As discussed above in the response to Observation 1, NIOSH performed an analysis of the 773-A laboratory areas during the 1980s in order to define a random number of samples needed (ORAUT 2017). The assumption was made that the sampling program across the SRS site during the 1980s would be consistent in its implementation. Therefore, a known dataset could be used to determine the number of random samples needed to estimate the true number of samples that were above the censoring level. This number was determined to be 750 samples. To collect a random set of sample results, a list of random days for each year to be sampled was created. The air sample results were compiled for each random day on the list until a total of at least 750 random sample results were compiled. If the 750<sup>th</sup> random sample result was compiled in the middle of the random day, all sample results for that day were included. This resulted in 795 results analyzed for 1975, 817 results analyzed for 1981, 753 results analyzed for 1984, and 750 results analyzed for 1987.

**SC&A Observation 4:** *Based on SC&A's analysis of the relative magnitude and location of positive air sampling results, SC&A agrees that the use of the CL of  $1 \times 10^{-12}$   $\mu\text{Ci}/\text{cm}^3$  over the course of an entire year represents a reasonable upper bound on the exposure potential to thorium under normal conditions associated with storage and material transfer activities.*

**NIOSH Response:** No response needed.

**SC&A Finding 1:** *Per the hierarchy of data criteria, bioassay sampling is considered scientifically preferable to other data and methods, such as the use of air sampling and/or modeling assumptions based on source term inventories. While alternate methods other than the use of bioassay monitoring may be useful in situations where exposure potential is essentially routine or ambient in the facility, such methods may not be applicable to workers involved in off-normal conditions, such as direct maintenance, modification of previously contaminated equipment, or other D&D activities.*

**NIOSH Response:** NIOSH agrees that, given the type of air data collected, the intake rate associated with these data should only be used for normal conditions. For off-normal conditions (e.g., direct maintenance, modification of previously-contaminated equipment, or other D&D activities), the use of the 50<sup>th</sup> percentile co-worker intake can be used to bound exposure; given the nature of this type of work, this approach would only apply to construction trade workers. The co-worker intake should be limited to the 50<sup>th</sup> percentile because there is no indication that these types of activities would result in air concentrations associated with the 95<sup>th</sup> percentile. The 95<sup>th</sup> percentile co-worker intake rates are based on a time period when thorium operations were being performed and trivalent radionuclide bioassay was being used (which would have captured additional radionuclides, thus biasing the co-worker intake high). NIOSH concludes that the 50<sup>th</sup> percentile would sufficiently bound any exposures associated with off-normal conditions for construction trade workers.

## **REFERENCES**

ORAUT (Oak Ridge Associated Universities) 2017, *Evaluation of Method for Assessment of Thorium-232 Exposures at the Savannah River Site from 1972 to 1989*, ORAUT-RPRT-0070, May 15. SRDB Ref ID: 166846

SC&A (SC&A, Inc.) 2018, *Memorandum: SC&A Review of RPRT-0070 Methods for Th-232 Dose Reconstruction*, October 11. SRDB Ref ID: 175229