

NIOSH Response to SC&A's Review of SEC-00250 Evaluation Report Addendum for the Y-12 Site

Response Paper

**National Institute for Occupational
Safety and Health**

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INTRODUCTION

SC&A reviewed NIOSH's *SEC-00250 Petition Evaluation Report Addendum* [NIOSH 2021] and documented its review in *Review of SEC-00250 Evaluation Report Addendum for the Y-12 Site* [SC&A 2025]. SC&A's review included identifying the applicability of prior SC&A Findings and Observations from *SC&A Review of the SEC-00250 Evaluation Report for the Y-12 Plant* [SC&A 2020] to the timeframe evaluated in the SEC-00250 Addendum. Additionally, SC&A identified new observations related to thorium-related activities and source terms, radiological control program, documented communications with former workers, and reviewing available thorium in vivo data. SC&A did not identify any new Findings related to the SEC-00250 Addendum period. NIOSH presents its responses to SC&A's Findings and observations in this document.

SC&A FINDINGS AND OBSERVATIONS AND NIOSH RESPONSE

SC&A determined that Findings 1, 3, 4, and all twelve of the observations presented in this document were previously identified in *SC&A Review of the SEC-00250 Evaluation Report For the Y-12 Plant* [SC&A 2020] were also applicable to the timeframe evaluated in the SEC-00250 Addendum. SC&A determined that while Finding 2 was still applicable, it was reclassified as an observation. Additionally, SC&A identified 13 new Observations that are specific to the SEC-00250 Addendum review. As such, SC&A's previously identified Findings and Observations are identified as "SC&A 2020" before the Finding or Observation number. Previously presented Findings and Observations that are unique to the Addendum include "Applicability for Addendum Period" after the 2020 Finding/Observation number. All new SC&A Observations are identified as "SC&A 2024 Observation" before the observation number.

SC&A 2020 Finding 1: Thorium Chest Count Co-exposure Model

SC&A 2020 Finding 1: *Available documentation only reports the number of quarterly thorium in vivo measurements up through the third quarter of 1981. For this limited time period, the completeness of in vivo thorium data available for dose reconstruction was approximately 95 percent. Direct evaluation of the completeness and availability of thorium in vivo records after this time is not currently possible.* [SC&A 2025, PDF p. 10]

NIOSH 2020 Response to Finding 1: *NIOSH acknowledges SC&A's 1980–1981 completeness analysis and intends to perform a formal completeness analysis as part of the development of the thorium chest-count co-exposure model.* [NIOSH 2020, PDF p. 6]

SC&A 2020 Finding 1 (Applicability for Addendum Period): *This finding appears to still be relevant, as the total amount of data that should be available for analysis is not known after 1981 and thus the amount of data is not available for the Addendum time period. While periodic health physics reports (discussed in section 5 of this report) gave total in vivo results for*

uranium, it is not clear that these totals are also representative of the in vivo thorium results. This would continue to pose issues in the Addendum period in establishing the completeness of the available dataset for co-exposure analysis. In its 2020 response, NIOSH acknowledged SC&A's finding 1 and indicated that a full completeness analysis would be performed as part of a future co-exposure modeling effort (NIOSH, 2020a). SC&A recommends this finding remain In Progress pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF p. 11]

NIOSH 2025 Response to Finding 1 (Applicability for Addendum Period): NIOSH concurs with this Finding and agrees that the commitment made in the NIOSH [2020] response paper is still open in regard to the 2019 Evaluation Report [NIOSH 2019]. Regarding the 1987–1994 data used in the SEC-250 ER Addendum (i.e., the subject of this review), NIOSH completed an assessment of the completeness of the 1987–1994 data and reported the results of that assessment in Section 7.1.1 of the SEC-00250 ER Addendum [NIOSH 2021].

...Y-12 stored monitoring data in two repositories within the period currently under evaluation (1987–1994). These two repositories are: (1) the Delta View Imaging System, comprised of scanned images of hard-copy reports and monitoring data printouts associated with Y-12 personnel dosimetry data and in-vivo results; and (2) the site's electronic record system (ERS) containing analytical results by individual, ID, bioassay type, date, and radionuclide.

NIOSH compared the Delta View Imaging System dataset with the contents of the first two datasets made available from the ERS. Although most workers' results could be identified in both datasets, it became apparent that some discrepancies existed. Some workers' data was found in the Delta View system but not in the ERS (669 records for the 1989–1991 period and 169 records for the 1992–1994 period). In addition, NIOSH noted that worker records, regardless of year, were predominantly from the 7000- and 9000-series departments that contained subcontracted construction workers.

In May 2020, NIOSH sent a data capture request to Y-12 [ORO-FY20-008] to clarify the apparent data-repository discrepancies and assess this potential data-pedigree issue [ORAUT 2020n]. Y-12 records personnel responded on August 20, 2020 with a data file intended to augment the existing 1958–1991 electronic data system lung count dataset [Martin Marietta 1958–1991]. The file contains an additional 735 measurements for contract personnel that were previously excluded. Y-12 also provided a more-detailed accounting of other previously-identified missing records (i.e., those located in the Delta View system but not in the Y-12 dosimetry record system) that remained absent from the 735 additional records [Martin Marietta 1989–1991; 1992–1995].

For the 669 records NIOSH identified for the 1989–1991 time period:

- 568 were provided in the update file.*
- 6 were determined to be invalid measurements by Y-12.*

- 43 were measurements for non-employees at the Y-12 site (i.e., measurements performed for other facilities).
- 52 were valid measurements but were inadvertently excluded from the electronic dosimetry record system due to a migration error. Y-12 indicated that the Delta View version of these records serves as the copy of record.

For the 169 records identified for the 1992–1994 time period:

- 89 were determined to be invalid measurements by Y-12.
- 4 were determined to be actually present in the Y-12 dosimetry record-keeping system under a different SSN (i.e., the SSN on the paper record was incorrect).
- 76 were valid measurements but were inadvertently excluded from the electronic dosimetry record system due to a migration error. Y-12 again indicated that the Delta View version of these records serves as the copy of record.

Though Y-12's "dose of record" for the period under evaluation occasionally resides in only one of two possible repository formats (i.e., the ERS and Delta View records systems), Y-12 has supplied NIOSH with both sources of the monitoring data applicable to the period under evaluation for this Addendum. Coupled with the results of NIOSH's evaluation of the Y-12 monitoring program, NIOSH concludes that the available monitoring data are sufficient in terms of quality, completeness, and representativeness for evaluating thorium intakes for the entire period under evaluation [1987–1994]. [NIOSH 2021, PDF pp. 21–22]

SC&A 2020 Finding 2: Thorium Monitoring

SC&A 2020 Finding 2: *Information on the annual processing and throughput of thorium materials at the Y-12 plant is currently unavailable to supplement the thorium monitoring completeness evaluation. Evidence suggests that such throughput information was once tabulated in existing documentation. However, it is likely the information was redacted from the source documentation and thus is not available for analysis at this time. [SC&A 2025, PDF p. 11]*

NIOSH 2020 Response to Finding 2: *After completing the SEC-00250 Evaluation Report, the thorium inventory became available and was captured to support the reserved period analysis. [NIOSH 2020, PDF p. 6]*

SC&A 2020 Finding 2 (Applicability for Addendum Period): This Finding was reclassified as SC&A 2024 Observation 1 and is covered below under that section.

SC&A 2020 Finding 3: Representativeness of Uranium Dataset

SC&A 2020 Finding 3: *Analysis of job title or other characteristics of the monitored population is not possible at this time in the uranium urinalysis dataset used in the Y-12 [co-exposure] model. Therefore, neither the evaluation of the representativeness of the dataset, nor the evaluation of the potential need for stratification of the uranium [co-exposure] model, is currently feasible. [SC&A 2025, PDF p. 12]*

NIOSH 2020 Response to Finding 3: *NIOSH acknowledges SC&A's review of the representativeness analysis for a job title or other characteristics of the monitored population and intends to perform an evaluation of the representativeness and need for stratification during the future revision of the uranium in urine co-exposure model. [NIOSH 2020, PDF p. 7]*

SC&A 2020 Finding 3 (Applicability for Addendum Period): *NIOSH (2020a) acknowledged SC&A's finding and indicates that characterization and potential need for stratification of the monitored population for the purposes of co-exposure development will be performed by NIOSH in future revisions of the uranium co-exposure model. SC&A recommends this finding remain In Progress pending development of future co-exposure models to address unmonitored intakes. SC&A assumes that NIOSH's proposed path forward would also apply to the Addendum period. [SC&A 2025, PDF p. 12]*

NIOSH 2025 Response to Finding 3 (Applicability for Addendum Period): NIOSH concurs with this Finding and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Finding 4: Plutonium-241 Monitoring Data

SC&A 2020 Finding 4: *Plutonium-241 is not addressed in the Y-12 SEC-00250 evaluation report, though the inability to reconstruct internal exposure to Pu-241 formed part of the basis of SEC-00251, which immediately precedes the SEC-00250 evaluation period. [SC&A 2025, PDF p. 13]*

NIOSH 2020 Response to Finding 4: *The availability of Pu-241 monitoring data is discussed in the SEC-00251 Evaluation Report. That evaluation indicated that Pu-241 exposure could not be reconstructed through 1966 due to a lack of Pu-241 monitoring data before 1967. Starting in 1967, a Pu-241 specific bioassay method was available and implemented as demonstrated by the abundance of such analytical results starting in 1967. Based on the availability of Pu-241 monitoring data, NIOSH did not identify any infeasibility specific to Pu-241 during the post-1966 time period. [NIOSH 2020, PDF p. 7]*

SC&A 2020 Finding 4 (Applicability for Addendum Period): *This issue was discussed in the SEC-00251 ER (NIOSH, 2018) and by the Y-12 Work Group at its September 2020 videoconference meeting. NIOSH has determined that an adequate bioassay method for*

measuring plutonium (Pu)-241 existed at Y-12 at least as early as 1967; therefore, no further infeasibility for Pu-241 was identified. While SC&A acknowledges that a suitable bioassay method likely was available (as documented in ORAUT (2018)), SC&A would note that a suitable exposure method for unmonitored exposures of Pu-241 will likely be required for the years after 1966 at the Y-12 Plant. [SC&A 2025, PDF p. 13]

NIOSH 2025 Response to Finding 4 (Applicability for Addendum Period): The Pu-241 work was performed in the actinide processing facility in Building 9204-3. The equipment and enclosures were cleaned, and readily dispersible material was removed when it was placed in standby in 1980 [Gibson et al. 1990, PDF p. 181]. The facility was then maintained in a manner that would minimize the likelihood that any residual contamination would spread to other areas. The 1990 *ORNL Isotopes Facilities Shutdown Program Plan* reported and summarized the status of the facility (presumably circa 1990) [Gibson et al. 1990], indicating that engineering controls continued to be in place to prevent the spread of contamination from the shutdown facility:

- *The components wash area operates at -0.15 in. w.g. [water gauge pressure] and the other areas at -0.1 in. w.g. relative to the surrounding building areas.*
- *Glove boxes and enclosures have HEPA filters on the air inlet and prefilters and HEPA filters on the exhaust. Air is then routed through a common duct system to a second stage of HEPA filters.*
- *Exhaust fans are supplied with emergency power.*
- *Entries are provided with air locks. [PDF p. 181]*

In 1994, the remaining inventory of Pu-241 (2 gram, greater than 90% Pu-241) were moved from Building 9204-3 to the Building 3027 Vault [Aaron 1994].

A 1999 characterization survey of the facility reported that “Building 9204-3 is in good physical condition. Contamination control actions appear to maintain contaminated areas of the facility in a stable condition [DOE 2000, PDF p. 4].”

Potential exposure to purified Pu-241 material ended when the facility was placed in standby status in 1980. Any potential exposure identified for an individual claimant will be addressed during the dose reconstruction process.

SC&A 2020 Observation 1: Thorium Exposures

SC&A 2020 Observation 1: *Although SC&A uncovered additional information concerning process departments and areas associated with thorium work, no definitive list was identified to aid in assessing the scope of thorium monitoring at the Y-12 plant. Sought-after documentation might have included those workers classified as thorium workers in addition to department and work area designations. Such information would have aided in evaluating the monitoring program's effectiveness and representativeness. [SC&A 2025, PDF p. 13]*

NIOSH 2020 Response to Observation 1: *NIOSH acknowledges SC&A's review of the effectiveness and representativeness concerning process departments and areas associated with thorium work. NIOSH intends to evaluate the adequacy of the thorium-monitoring program as part of the development of the thorium chest-count co-exposure model. [NIOSH 2020, PDF p. 7]*

SC&A 2020 Observation 1 (Applicability for Addendum Period): *This observation is also relevant for the Addendum period because identifying work activities potentially involving thorium exposures and, more importantly, the workers involved in those activities is important in establishing that the available monitoring data are sufficiently complete and representative of the exposed population. NIOSH (2020a) acknowledged the observation and indicated that evaluation of the thorium-monitoring program will be part of the development of a thorium chest-count co-exposure model. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes. It is important to note that documented communications with former Y-12 workers indicated that thorium workers were not specifically identified and selected for in vivo monitoring (refer to section 6, 2024 observation 11). [SC&A 2025, PDF p. 13]*

NIOSH 2025 Response to Observation 1 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 2: Mobile In Vivo Radiation Monitoring Laboratory (MIVRML)

SC&A 2020 Observation 2: *The in vivo monitoring program using the stationary count facilities at the Y-12 Plant employed essentially identical methods and equipment as the Mobile In Vivo Radiation Monitoring Laboratory (MIVRML), which was likewise developed at Y-12. The Board has previously evaluated the adequacy of the MIVRML system at the Fernald site and found it to be a reasonable and scientifically accurate monitoring methodology for use in EEOICPA. [SC&A 2025, PDF p. 13]*

NIOSH 2020 Response to Observation 2: *NIOSH acknowledges SC&A's verification that Y-12 employed essentially identical methods and equipment as the MIVRML, and that the Board has previously evaluated the MIVRML at Fernald and found it to be a reasonable and scientifically accurate monitoring method. [NIOSH 2020, PDF p. 8]*

SC&A 2020 Observation 2 (Applicability for Addendum Period): *This observation is relevant for the part of the Addendum period for which the lung counts of the thorium daughter products ([lead-212] Pb-212 and [actinium-228] Ac-228) are present for analysis. This observation would not apply to the period for which only Ac-228 measurements are available. However, as discussed at the September 2020 meeting of the Y-12 Work Group, scientifically acceptable methods are available and have been used in previous SEC discussions of the Fernald site in which the Board found the methods acceptable when both daughter products are*

present. The methods used to address the period in which only Ac-228 measurements are available are discussed and evaluated in section 7.2 of this report. [SC&A 2025, PDF pp. 13–14]

NIOSH 2025 Response to Observation 2 (Applicability for Addendum Period): NIOSH concurs with this Observation and notes that no additional action is required; therefore, we recommend that this Observation be closed.

SC&A 2020 Observation 3: Ac-228 and Pb-212 Bias

SC&A 2020 Observation 3: *SC&A's evaluation of the potential for bias in the data identified a negative bias in the Ac-228 data for the years 1981–1986 and Pb-212 for 1981–1984. NIOSH should consider developing adjustment factors to assure any negative bias in the reported results is correctly accounted for in a claimant-favorable manner. [SC&A 2025, PDF p. 14]*

NIOSH 2020 Response to Observation 3: *NIOSH acknowledges SC&A's evaluation and the identification of a negative bias in the Ac-228 data for 1981–1986, and Pb-212 for 1981–1984. NIOSH intends to perform a formal evaluation of the potential for bias in the data as part of developing a thorium chest-count co-exposure model. Note: NIOSH did perform this analysis for Fernald Thorium data. [NIOSH 2020, PDF p. 8]*

SC&A 2020 Observation 3 (Applicability for Addendum Period): *This observation is relevant for the part of the Addendum period for which the lung counts of the thorium daughter products (Pb-212 and Ac-228) are present for analysis. NIOSH (2020a) acknowledged SC&A's observation and will provide a formal evaluation of the potential for bias in the data as part of its development of the thorium chest-count co-exposure model. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF p. 14]*

NIOSH 2025 Response to Observation 3 (Applicability for Addendum Period): The Y-12 Internal Dose Technical Basis Document (ORAUT-TKBS-014-5) was updated on August 3, 2023 [NIOSH 2023] and that update includes bias correction factors for both Pb-212 and Ac-228 (see Table 5-13 of ORAUT-TKBS-014-5) [NIOSH 2023, PDF p. 36].

SC&A 2020 Observation 4: Pb/Ac Data

SC&A 2020 Observation 4: *Evidence suggests additional Pb/Ac in vivo data may be available that were not considered in the SEC-00250 ER due to their in vivo "type" designation. Limited analysis of omitted data discovered for January 1983 suggests the data are comparable to or in some cases greater than, the current database values under consideration. NIOSH should consider capturing and analyzing any additional data unless sufficient justification exists for omitting such monitoring results. [SC&A 2025, PDF p. 14]*

NIOSH 2020 Response to Observation 4: *NIOSH has hardcopy records for all 12 months of 1983 [UCC 1982–1983a,b,c; UCC 1983a,b,c,d,e,f,g,h,i]. These records contain the raw counting results, as recorded on a datasheet, associated with measurements performed in 1983 [including Ac and Pb results for all count type]. NIOSH also has similar data for the period 1989–1991. NIOSH has attempted to obtain data for additional years and has requested such data from Y-12. However, Y-12 has not been able to locate any additional datasets containing such information.*

The electronic dataset for the entire evaluated time period is available and is the source of the information used in the evaluation report. This electronic dataset contains Ac and Pb results for all measurements, which are identified as thorium related measurements [i.e., analysis Type 6 and 7].

NIOSH intends to perform a formal analysis of the completeness of the thorium dataset during the development of the thorium chest-count co-exposure model. [NIOSH 2020, PDF p. 8]

SC&A 2020 Observation 4 (Applicability for Addendum Period): *NIOSH (2020a) indicated that attempts to obtain additional data have been requested from the site, but at the time of writing, additional information had not yet been located. NIOSH (2020a) also indicated that a formal analysis that evaluates the completeness of thorium monitoring data will be performed as part of future co-exposure modeling development. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF p. 14]*

NIOSH 2025 Response to Observation 4 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 5: Thorium In Vivo Dataset (Individual Worker Focus)

SC&A 2020 Observation 5: *Analysis of available job title information for claimants included in the available thorium in vivo dataset suggests that the monitoring program can be best described as “routine, representative sampling.” SC&A did not identify any evidence that the monitoring program systematically excluded workers with higher exposure potential that might preclude the use of such data in [co-exposure] modeling. [SC&A 2025, PDF p. 14]*

NIOSH 2020 Response to Observation 5: *NIOSH acknowledges SC&A's analysis of job title information for claimants in the thorium in vivo dataset. NIOSH intends to perform a formal evaluation as part of developing a thorium chest-count co-exposure model. [NIOSH 2020, PDF p. 9]*

SC&A 2020 Observation 5 (Applicability for Addendum Period): *NIOSH (2020a) indicated that it intends to perform a formal analysis of job title information to determine the*

representativeness of the monitored population for use in future co-exposure development. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF pp. 14–15]

NIOSH 2025 Response to Observation 5 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 6: Thorium In Vivo Dataset (Department Focus)

SC&A 2020 Observation 6: *Analysis of available departmental information included in the thorium in vivo dataset suggests the monitoring program is likely best described as “routine, representative sampling.” SC&A did not identify any evidence that the monitoring program systematically excluded departments with higher exposure potential that might preclude the use of such data in [co-exposure] modeling. [SC&A 2025, PDF p. 15]*

NIOSH 2020 Response to Observation 6: *NIOSH acknowledges SC&A's analysis of departmental information included in the thorium in vivo dataset. NIOSH intends to evaluate the representativeness of the thorium monitoring data as part of the development of a thorium chest-count co-exposure model. [NIOSH 2020, PDF p. 9]*

SC&A 2020 Observation 6 (Applicability for Addendum Period): *NIOSH (2020a) indicated that it intends to perform a formal analysis of all relevant information to determine the representativeness of the monitored population for use in future co-exposure development. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF p. 15]*

NIOSH 2025 Response to Observation 6 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 7: Uranium Data Representativeness

SC&A 2020 Observation 7: *Completeness analysis of the uranium data from August 1979 through December 1988 showed that quarterly, the percentage of available data in comparison to health physics reports ranged from 75 percent to 121 percent of the reported totals. The average overall evaluated quarters was 98.4 percent. Completeness analysis after this period is not currently feasible. [SC&A 2025, PDF p. 15]*

NIOSH 2020 Response to Observation 7: *NIOSH acknowledges SC&A's completeness analysis of the uranium data. NIOSH intends to perform a formal completeness analysis as part of the revision of the existing uranium in urine co-exposure model. [NIOSH 2020, PDF p. 9]*

SC&A 2020 Observation 7 (Applicability for Addendum Period): *NIOSH (2020a) indicated that it intends to perform a formal analysis of job title information to determine the representativeness of the monitored population for use in future co-exposure development. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes.* [SC&A 2025, PDF p. 15]

NIOSH 2025 Response to Observation 7 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open. It should be noted, however, that the statement made by SC&A regarding applicability to the period covered in the SEC-00250 Addendum cites the response to Observation 5 as opposed to Observation 7.

SC&A 2020 Observation 8: Uranium Co-Exposure Models

SC&A 2020 Observation 8: *The Y-12 [co-exposure] model currently uses uranium urinalysis results in developing unmonitored intakes. Urinalysis was the primary method for monitoring for uranium exposure at Y-12, and it appears to have captured the more highly exposed workers as demonstrated by the number of workers exceeding the plant action value. However, there was a substantial amount of in vivo monitoring as well. Such in vivo monitoring should be discussed in the context of developing [co-exposure models] to assure that the chosen method is claimant favorable.* [SC&A 2025, PDF p. 15]

NIOSH 2020 Response to Observation 8: *NIOSH acknowledges SC&A's review of the uranium urinalysis results. NIOSH notes there was a substantial amount of in vivo monitoring that may be discussed in the context of developing a co-exposure model to ensure the method is claimant favorable. NIOSH intends to perform a formal evaluation as part of the revision of the uranium in urine co-exposure model.* [NIOSH 2020, PDF pp. 9–10]

SC&A 2020 Observation 8 (Applicability for Addendum Period): *NIOSH (2020a) agreed that a substantial amount of in vivo monitoring exists that could be considered in co-exposure model development. NIOSH indicated that such data would be considered to assure that future uranium co-exposure models are claimant favorable. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes.* [SC&A 2025, PDF p. 15]

NIOSH 2025 Response to Observation 8 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 9: Uranium Air Concentrations

SC&A 2020 Observation 9: *Average uranium air concentrations provided for three categories of uranium operations in the quarterly health physics reports indicate that “fabrication” (which is described as machining operations in enriched uranium areas) was consistently bounded by the other two operational categories (both of which are labeled “metal preparation”).* [SC&A 2025, PDF p. 16]

NIOSH 2020 Response to Observation 9: *NIOSH acknowledges SC&A’s review of the average uranium air-concentrations. NIOSH intends to perform a formal analysis of the need for data stratification as part of the revision of the uranium in urine co-exposure model.* [NIOSH 2020, PDF p. 10]

SC&A 2020 Observation 9 (Applicability for Addendum Period): *NIOSH (2020a) agreed that the potential issue of stratification of co-exposure models should be evaluated during future co-exposure model development. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes.* [SC&A 2025, PDF p. 16]

NIOSH 2025 Response to Observation 9 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open. It should be noted that there are no plans to base a co-exposure analysis on air sample data; instead, the current and any future updates will use uranium bioassay data.

SC&A 2020 Observation 10: Data Stratification

SC&A 2020 Observation 10: *Evaluation of claimant monitoring records, for workers who are identified only as machinists and who were monitored externally, found that 40–60 percent were also monitored for uranium by year. When considering whether claimant Machinists would theoretically require application of a [co-exposure] model during dose reconstruction, SC&A found that around 51 percent would not require any [co-exposure] assignment, around 24 percent would require partial [co-exposure] assignment, and around 25 percent would require [co-exposure] assignment for all externally monitored years.* [SC&A 2025, PDF p. 16]

NIOSH 2020 Response to Observation 10: *NIOSH acknowledges SC&A’s review of claimant monitoring records [for] workers who are identified only as machinists. NIOSH intends to perform a formal analysis of the need for data stratification as part of the revision of the uranium in urine co-exposure model.* [NIOSH 2020, PDF p. 10]

SC&A 2020 Observation 10 (Applicability for Addendum Period): *NIOSH (2020a) agrees that the potential issue of stratification of co-exposure models should be evaluated during future co-exposure model development. SC&A recommends this observation remain In Progress*

pending development of future co-exposure models to address unmonitored intakes. [SC&A 2025, PDF p. 16]

NIOSH 2025 Response to Observation 10 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 11: ORAUT-RPRT-0090 Open Findings and Observations

SC&A 2020 Observation 11: *SC&A has several open findings and observations for RPRT-0090 pertinent to the ER. These findings are currently under the purview of the Board for consideration. [SC&A 2025, PDF p. 16]*

NIOSH 2020 Response to Observation 11: *NIOSH will address these open findings that relate to ORNL and Y-12 isotope groups as a part of the response and revision of ORAUT-RPRT-90. [NIOSH 2020, PDF p. 10]*

SC&A 2020 Observation 11 (Applicability for Addendum Period): *SC&A's review (SC&A, 2018) of ORAUT-RPRT-0090, revision 00 (ORAUT, 2018; "RPRT-0090"), was discussed by the Oak Ridge National Laboratory (ORNL)/X-10 Work Group on June 30, 2021 (ABRWH, 2021), where it was determined that RPRT-0090 was intended to demonstrate the feasibility to monitor internally for many exotic radionuclides. As SC&A's pertinent review findings and observations regarding RPRT-0090 (SC&A, 2018, 2020) were generally specific to the application of bioassay methodology and available data in the development of co-exposure modeling, it was determined that those open issues be handled with the development of co-exposure modeling or unmonitored internal dose matrices as applicable to ORNL.*

Furthermore, SC&A notes that NIOSH has recently delivered an updated revision of RPRT-0090 in Spring 2023. [SC&A 2025, PDF pp. 16–17]

NIOSH 2025 Response to Observation 11 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2020 Observation 12: Post-1983 Isotopes Group

SC&A 2020 Observation 12: *Post-1983 Isotopes Group radioisotope exposures were not addressed in the Y-12 SEC-00250 evaluation report. In particular, the ER does not address residual exposures to contaminated areas and process equipment. [SC&A 2025, PDF p. 17]*

NIOSH 2020 Response to Observation 12: *NIOSH will address these open findings that relate to ORNL and Y-12 isotope groups as a part of the response and revision of ORAUT-RPRT-90.* [NIOSH 2020, PDF p. 10]

SC&A 2020 Observation 12 (Applicability for Addendum Period): *Although actual operations of the Isotopes Group may have ceased in 1983, this observation relates to the potential for residual contamination exposures and thus is relevant to the SEC-00250 Addendum period. NIOSH indicated that issues related to the Isotopes Group would be addressed as part of the development of methods to assess unmonitored exposures to exotic radionuclides. SC&A recommends this observation remain In Progress pending development of future co-exposure models to address unmonitored intakes.* [SC&A 2025, PDF p. 17]

NIOSH 2025 Response to Observation 12 (Applicability for Addendum Period): NIOSH concurs with this Observation and agrees that the commitment made in the NIOSH [2020] response paper is still open.

SC&A 2024 Observation 1: Thorium Inventory Estimates in Table 5-3 of Addendum

SC&A 2024 Observation 1: *The thorium inventory estimates presented in table 5-3 of the NIOSH ER Addendum (NIOSH, 2021) appear to disagree with alternate information provided in Chaffman (2019). The source of the discrepancy should be identified to assure that the correct inventory of thorium is reported. However, SC&A notes that the higher estimates of the thorium inventory were reported in NIOSH (2021).* [SC&A 2025, PDF p. 12]

NIOSH 2025 Response to SC&A 2024 Observation 1: As SC&A indicates, the inventory provided in the SEC-00250 Addendum was the highest of the data sources available to NIOSH. While the nature of the discrepancy is not known, it is likely due to the difference in the data sources used. The data contained in Chaffman [2019] were based on a compilation of transaction data viewed by the ORAU Team and NIOSH personnel at the National Nuclear Security Administration in Germantown, Maryland. The data used in the SEC-00250 Addendum were provided directly by DOE in response to a request for the thorium data redacted from the document titled *Historical Review of Accountable Nuclear Materials at the Y-12 Plant* [Owings 1995]. This information is the most accurate accounting of the thorium inventory. The data in Chaffman do, however, provide insight into the types of material present, indicating that the increase in thorium observed from 1994 to 1995 was due to the presence of weapons awaiting disassembly. In any case, while the thorium inventory data provide a general sense of the thorium activities at Y-12, they are not directly relied upon to establish NIOSH's ability to bound thorium doses. NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 2: Radiological Characterization of All Indoor Areas

SC&A 2024 Observation 2: *A 1993 Health and Safety report indicated that a project was to be conducted during 1994 to perform a radiological characterization of all indoor areas at the Y-12 site. SC&A was unable to locate the results of the project but notes this would be useful in evaluating the extent of thorium contamination at the site. [SC&A 2025, PDF p. 21]*

NIOSH 2025 Response to SC&A 2024 Observation 2: NIOSH concurs with the interest in such materials. However, no such materials have been located.

SC&A 2024 Observation 3: Smear Surveys from 2000

SC&A 2024 Observation 3: *Smear surveys from the year 2000 at Y-12, including the press area of the thorium room (9204-4), the canning room (9201-1), and related to a scrap reclamation operation (9201-5), showed both removable and fixed contamination. While these were taken outside of the Addendum period, it is not immediately clear if these represent residual contamination relevant to SEC-00250 exposures. [SC&A 2025, PDF p. 22]*

NIOSH 2025 Response to SC&A 2024 Observation 3: The survey results represent total alpha activity (either fixed or removable), with the highest removable activity being 1500 dpm/100 cm² total alpha. Isotopic results associated with the surveys in 9201-5 and 9204-4 are shown in Appendix B of the *Atypical Radionuclide Assessment* [Oliver 2001, PDF pp. 47 and 49, respectively] and indicate that the majority of the activity measured (i.e., greater than 98%) was uranium. The total and removable alpha contamination level documented on the survey in 9201-1 were both less than the reporting level and were both preceded with "<." Documentation of residual thorium activity as a small fraction of the total contaminants present is not unexpected, particularly in areas where thorium was previously processed, as indicated by the area titles in these surveys. Internal dose from thorium is assigned to all individual claimants with a potential for thorium exposure based on their individual claimant information. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 4: Termination Urinalysis Samples

SC&A 2024 Observation 4: *A radiological work permit dated August 1994 and associated correspondence describe drilling and milling on a 4-foot diameter case of magnesium-thorium and express concern that the workers involved had not submitted baseline urinalysis samples as required. It is not clear to SC&A at this time whether termination urinalysis samples were taken at the end of the operation. As noted in table 2 of this report, an internal assessment in 1998 through the first quarter of 1999 found deficiencies in appropriate completion and correction of RWP sign-in sheets, though it was concluded these had minimal impact on worker doses. [SC&A 2025, PDF p. 22]*

NIOSH 2025 Response to SC&A 2024 Observation 4: Thorium bioassay data associated with the individuals identified as working in the designated Thorium Area [Evans 1994, PDF p. 35] are available in the Y-12 internal dosimetry database provided to DCAS in October 2022 [Y-12 1950–2022]. NIOSH concurs with the Observation regarding the failure to perform baseline bioassay sampling. This fact is noted in dose assessment reports for [redacted] individuals involved in this work [Y-12 1943–2010, PDF p. 126; Y-12 1978–2009, PDF p. 203]. These assessments indicated that no occupational exposure to thorium occurred [Y-12 1978–2009, PDF p. 206]. Therefore, NIOSH can bound thorium doses related to work completed under this RWP. NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 5: Baseline and Termination Urinalysis

SC&A 2024 Observation 5: *An internal dosimetry technical basis document from 1995 (just after the evaluated period) states that baseline and termination urinalysis samples should be taken for any thorium-specific operations due to their isolated nature. It is not clear to what extent such samples were taken during the Addendum period. However, SC&A did identify a few instances of thorium urinalysis monitoring in 1990 and 1991 (SRDB 046680, 046795, 113914, and 114153). [SC&A 2025, PDF p. 22]*

NIOSH 2025 Response to SC&A 2024 Observation 5: While the bioassay samples contained in SRDB Ref ID: 46680 [TMA/Eberline 1990] and SRDB Ref ID: 46795 [TMA/Eberline 1990–1991] appear to be associated with work at Oak Ridge National Laboratory by Bechtel (i.e., not associated with Y-12), NIOSH concurs with the general Observation that thorium bioassay data are available at Y-12 starting in 1993. Both urine and fecal samples were collected and are associated with specific Y-12 claimant records. When such data are present in claimant files, the data are used in conjunction with other monitoring data to determine a claimant-favorable assessment of internal exposure. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 6: In Vitro Results and Thorium Exposure Potential

SC&A 2024 Observation 6: *According to guidance from the 2014 document, “Interpretation of Y-12 Thorium Monitoring Results” (SRDB 137020), lung counts for thorium during the time period of interest are considered screening and were performed whether the individual worked with thorium or not. If a worker has in vitro results beginning in 1994 and on, it can be inferred the worker had exposure potential to thorium. [SC&A 2025, PDF p. 22]*

NIOSH 2025 Response to SC&A 2024 Observation 6: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 7: Fixed Thorium Contamination in 2012

SC&A 2024 Observation 7: *One saw was found with fixed thorium contamination in 2012, which indicates that residual thorium still existed at the Y-12 facility well after the evaluated SEC period. However, given that no removable component was identified with the contamination, any internal exposure potential would be minimal.* [SC&A 2025, PDF p. 22]

NIOSH 2025 Response to SC&A 2024 Observation 7: NIOSH concurs with SC&A's conclusion that "any internal exposure potential would be minimal." Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 8: Increase in Monitoring in Late 1980s and 1990s

SC&A 2024 Observation 8: *Examination of quarterly health physics reports indicates a significant increase in monitoring coverage in the late 1980s and early 1990s. This is reflected in the increased number of dosimeters issued, internal uranium analyses, permanent air sampling stations, and radiation surveys performed.* [SC&A 2025, PDF p. 29]

NIOSH 2025 Response to SC&A 2024 Observation 8: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 9: Health Physics Reports and Thorium Activities

SC&A 2024 Observation 9: *Although the quarterly health physics reports provided information on external and internal monitoring for uranium, area surveys, safety audits, and air monitoring results (including the elevated areas and operations), thorium activities were never specifically mentioned in any of these regular reports.* [SC&A 2025, PDF p. 29]

NIOSH 2025 Response to SC&A 2024 Observation 9: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 10: Radiation Work Permits to Determine Bioassay Requirements

SC&A 2024 Observation 10: *Former workers indicated an RWP program was implemented in the mid-1980s and that the RWPs were used to determine bioassay requirements in at least some instances.* [SC&A 2025, PDF p. 34]

NIOSH 2025 Response to SC&A 2024 Observation 10: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 11: No Defined Group of Thorium Workers for Internal Thorium Monitoring Purposes

SC&A 2024 Observation 11: *Interviewees indicated that there was no defined group (referred to by the interviewees as a cohort) of thorium workers identified for specific internal thorium-monitoring purposes. [SC&A 2025, PDF p. 34]*

NIOSH 2025 Response to SC&A 2024 Observation 11: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 12: Thorium Stewardship

SC&A 2024 Observation 12: *Documented communications with former workers indicated that the thorium arc-melting operations likely ended in the late 1980s. It was generally indicated that the majority of thorium exposure after this time was likely related to stewardship, such as dispositioning of contaminated parts and any decontamination and decommissioning activities in prior thorium areas. [SC&A 2025, PDF p. 34]*

NIOSH 2025 Response to SC&A 2024 Observation 12: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 13: In Vivo Monitoring Program for Thorium

SC&A 2024 Observation 13: *Evaluation of a limited set of claimants identified within the available thorium dataset indicates that the in vivo monitoring program for thorium is likely reflective of routine, representative sampling rather than a focused sampling of any one particular worker category (e.g., thorium workers). This is consistent with SC&A's analysis of the earlier portion of the SEC-00250 period (August 1979–December 1986) as well as former worker interview statements. [SC&A 2025, PDF p. 40]*

NIOSH 2025 Response to SC&A 2024 Observation 13: NIOSH concurs with this Observation and notes that no additional action is required. Therefore, NIOSH recommends that this Observation be closed.

SC&A 2024 Observation 14: Alternative Approach to Evaluating Pb-212

SC&A 2024 Observation 14: *SC&A identified an alternate approach to evaluating the Pb-212 MDA that may be advantageous in that it can easily identify outliers. SC&A recommends NIOSH consider the use of such a method as a complement to the DCAS-RPT-008 methodology. [SC&A 2025, PDF p. 49]*

NIOSH 2025 Response to SC&A 2024 Observation 14: The focus of the alternate approach presented by SC&A was on the ability to justify the outlier measurements. NIOSH specifically excluded a single measurement with [redacted] counts in the [redacted] channel from its analysis. The reason the count in question was excluded was that [redacted] individual counted [redacted] before the measurement was taken [Y-12 1989–1995, PDF p. 489]. This detail was inadvertently excluded from DCAS-RPT-008. Therefore, NIOSH recommends that this Observation be closed.

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NOTE: Associated PDF page numbers may change when the DOE release letter is added to the SRDB file.

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