



Current Status of W. R. Grace TBD Findings

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To the Advisory Board on Radiation and
Worker Health

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W. R. Grace and Company, Erwin, Tennessee

- ◆ Atomic Workers Employer (AWE) 1958–1970
- ◆ Residual period 1971–2011
- ◆ W. R. Grace and Company (WRG) changed to Nuclear Fuel Services (NFS) in 1964
- ◆ Special Exposure Cohort (SEC) 1/1/1958–12/31/1970 due to lack of thorium data
- ◆ Processed weapons-related and non-weapons-related uranium, plutonium, and thorium

W. R. Grace TBD, SC&A's findings

- ◆ NIOSH issued WRG ORAUT-TKBS-0043 (TBD), revision 02, 9/16/2011.
- ◆ SC&A conducted onsite interviews Oct. 2012.
- ◆ SC&A issued review of ORAUT-TKBS-0043, revision 02, 1/16/2013.
- ◆ SC&A's review listed 7 findings and 4 secondary findings (observations).

Finding 1: Accuracy and completeness of bioassay records not addressed

- ◆ The accuracy and completeness of the recorded bioassay data have not previously been addressed as part of a routine verification and validation (V&V) database review.
- ◆ 8/28/2019: NIOSH issued a white paper addressing finding 1. There were 3 claims yet to be resolved.

Finding 1: SC&A's evaluation

- ◆ SC&A evaluated NIOSH's white paper on V&V of the recorded bioassay data. SC&A issued an evaluation report on 11/19/2019.
- ◆ SC&A found that NIOSH's analysis of all the WRG claimant bioassay data in NOCTS was inclusive and covered the many time periods at the various facilities for the uranium and plutonium radionuclides of concern.

Finding 1: Bioassays and coworker data

- ◆ SC&A found that, in general, workers were bioassayed.
- ◆ For workers who should have been, but were not, monitored, NIOSH provides coworker (CW) or environmental intakes for dose reconstruction purposes in its responses to findings 2, 3, and 7, and in the TBD.

Finding 1: Resolution and closure

- ◆ 1/30/2020: NIOSH presented resolution of the three remaining claimant files (two claimants' files located and the third claimant was compensated using other records).
- ◆ 1/30/2020: The finding was discussed by the WRG work group (WG). The WG found the finding satisfactorily addressed and the issues resolved. The WG **closed** the finding.

Finding 2: Insufficient uranium bioassay/intake data

- ◆ SC&A questioned the appropriateness of using a 1961 air concentration data point for operating conditions at WRG during the entire operational period.
- ◆ Additional investigation of the use of the 1961 data for 1958–1970 is needed.

Finding 2: There were two periods of concern for uranium intake

- ◆ AWE operational period intakes (1958–1970).
- ◆ Residual contamination period intakes (1971–2011).
- ◆ NIOSH’s approach to resolving the intakes for these two periods was discussed during the 8/3/2015 WRG WG teleconference and accepted.
- ◆ Since NIOSH’s resolution was a bounding approach, the WG recommended NIOSH provide further breakdown of the intakes by worker categories.

Finding 2: NIOSH white paper of July 22, 2019

- ◆ NIOSH issued “NIOSH Resolution of W. R. Grace Site Profile Findings 2 and 7.”
- ◆ The white paper provided inhalation and ingestion intakes by worker categories.
 - Table 1 for the AWE operational period intakes (1958–1970)
 - Table 2 for the residual contamination period intakes (1971–2011)

Finding 2: SC&A's evaluation of NIOSH's white paper

- ◆ SC&A analyzed the derivation of NIOSH's intake values, in conjunction with recommendations in Battelle-TBD-6000, revision 01, "Site Profiles for Atomic Weapons Employers that Worked Uranium Metals."
- ◆ SC&A evaluation report was issued 11/18/2019.

Finding 2: SC&A's evaluation of NIOSH's white paper for first period

- ◆ AWE operational period intakes (1958–1970): SC&A concurs with the intake values listed in table 1 of the white paper for the operational period.

Finding 2: SC&A's evaluation of NIOSH's white paper for second period

- ◆ Residual contamination period intakes (1971–2011): SC&A analyzed the derivation of NIOSH's intake values, in conjunction with recommendations in Battelle-TBD-6000, and concurs with the intake values listed in table 2 of the white paper for the residual period.

Finding 2: Conclusion and closure

- ◆ SC&A found that NIOSH sufficiently addressed finding 2 concerning insufficient uranium bioassay/intake data.
- ◆ SC&A had no further issues concerning this finding.
- ◆ The finding was discussed at the 1/30/2020 AWE WG meeting and **closed**.

Finding 3: Plutonium doses during either period are not consistent with the SEC

- ◆ Using operational-period plutonium results, but not using residual-period plutonium results, and not estimating non-bioassayed workers' plutonium doses, are not consistent with the SEC because the SEC was based on thorium, not plutonium.
- ◆ 3/1/2019: NIOSH issued a white paper addressing finding 3.

Finding 3: SC&A's evaluation

- ◆ SC&A's evaluation of the white paper found that NIOSH used the recommended methods, per approved appropriate procedural documents, to derive reasonable CW data from the available recorded bioassay and air monitoring data. SC&A issued a report on 8/30/2019. SC&A did not identify any findings but did have three observations.

Finding 3: SC&A's three observations

- ◆ Observation 1: Need to address extension of 1967 data to include 1965 and 1967.
- ◆ Observation 2: Use of 30 percent and 3.9 percent factors in deriving data in tables is unclear.
- ◆ Observation 3: Were in vivo bioassays required or performed for decontamination and decommissioning (D&D) workers?

Finding 3: NIOSH's response to the three observations

- ◆ Observation 1: Plutonium inventory was much less in 1965 & 1966 than in years bioassays were available; therefore, extension of 1967 data to 1965 & 1966 is reasonable.
- ◆ Observation 2: The difference in the plot data and the table data is due to adjustment of 365 day to 250 days, as SC&A suggested in their evaluation.
- ◆ Observation 3: Although the wording concerning bioassays is not clear in one of the documents, NIOSH found urine, fecal, and in vivo data during the D&D phase.

Finding 3: Conclusion and closure

- ◆ 1/30/2020: The finding was discussed during the WRG WG teleconference.
- ◆ The WG found the finding satisfactorily addressed and the issues resolved.
- ◆ The WG **closed** the finding.

Finding 4: Lack of neutron dose assignment

- ◆ SC&A questioned the lack of neutron dose assignment.
- ◆ SC&A did not locate any recorded neutron doses in the claimants' files reviewed.
- ◆ Further investigation of the potential neutron exposure and methods to assign appropriate neutron dose was needed.

Finding 4: Response to SC&A's concern

- ◆ NIOSH agreed that further investigation was necessary.
- ◆ 8/3/2015: The finding was discussed during the WRG WG teleconference.
- ◆ SC&A agreed that the proposed neutron-to-photon (N:P) approach was reasonable and would evaluate the data and recommended methods when available.

Finding 4: NIOSH white paper of May 1, 2017

- ◆ NIOSH issued “Neutron Dose Assignment for Plutonium Fuel at W.R. Grace.”
- ◆ In the white paper, NIOSH analyzed the N:P ratios at other U.S. Department of Energy (DOE) sites that processed plutonium in a similar manner and of similar composition as at WRG.
- ◆ SC&A evaluated NIOSH’s white paper and issued a memorandum 9/26/2017.

Finding 4: SC&A's evaluation of NIOSH's white paper

- ◆ SC&A reviewed N:P ratios used at other DOE sites that processed plutonium and found them to range from 0.21 to 1.1 for non-glovebox workers, and to range from 1.0 to 1.7 for glovebox workers.
- ◆ SC&A had reviewed revision 03 to the Nuclear Materials Equipment Corporation (NUMEC) site profile in 2017 and concurred with NIOSH's recommended N:P ratio geometric mean (GM) value of 0.34 for non-glovebox workers and N:P ratio GM value of 1.00 for glovebox workers at NUMEC.

Finding 4: SC&A had remaining concerns

While SC&A concurred with NIOSH's use of NUMEC N:P values for WRG workers, SC&A did have the following three areas of concern:

Concern 1: SC&A did not find that NIOSH's recommendations for the determination of potential neutron exposure to be applicable to WRG because:

- ◆ There was no significant AWE neutron monitoring at WRG.
- ◆ Detailed dosimetry information is not available for WRG.
- ◆ Criteria for selecting neutron-exposed workers at other sites is not very useful at WRG.

Finding 4: SC&A's concerns 2 and 3

Concern 2: Potential for neutron exposure from plutonium needs to be addressed during other periods, such as the D&D phase (1987–1994), for workers involved in those operations.

Concern 3: Neutron exposures from uranium (ORAUT-TKBS-0043, revision 02, page 28) were not included in NIOSH's white paper and have yet to be addressed.

Finding 4: Resolutions

- ◆ Finding 4 was discussed during the 1/30/2020 WRG WG teleconference with the following resolutions to SC&A's concerns:
 1. NIOSH will use worker categories to assign neutron dose, not the method suggested in the white paper.
 2. NIOSH has neutron monitoring requirements and data for the D&D phase.
 3. NIOSH will use the N:P ratios in ORAUT-RPT-0060 to estimate neutron dose for work with enriched uranium (applicable from 1958–1970).

Finding 4: Conclusion and closure

- ◆ NIOSH will revise the TBD to reflect these three areas of concern and their resolutions.
- ◆ The WG found the finding satisfactorily addressed and the issues resolved. The WG **closed** the finding.

Finding 5: Lack of dosimetry calibration knowledge

- ◆ 8/3/2015: This finding was discussed during the WRG WG teleconference.
- ◆ August 2015: SC&A performed searches on the SRDB and did not locate additional relevant information concerning dosimetry calibration.

Finding 5: SC&A's review

- ◆ 8/25/2015: NIOSH reviewed several claims to see if there was a noticeable change in reported dose when Landauer began providing dosimeter services in 1961. The claims reviewed did not indicate that there was a sudden increase in dose in 1961.
- ◆ 3/21/2016: SC&A contacted NFS and a former Landauer dosimetrist in an attempt to determine the calibration of WRG badges during the earlier periods at WRG. SC&A did not find any definitive information.

Finding 5: Conclusion and closure

- ◆ 3/21/2016: SC&A did not find indications that future research would significantly alter the external doses assigned and suggested closing this issue.
- ◆ 7/19/2016: This issue was discussed and **closed** at the WRG WG teleconference.

Finding 6: Onsite medical x-ray exams not substantiated

- ◆ 8/3/2015: This finding was discussed during the WRG WG teleconference.
 - There is no documentation that x-ray exams were performed off site.
 - Since the exams may have been performed on site, the WRG TBD and ORAUT-OTIB-0079 apply.
 - The WG considered the finding resolved.
 - Status changed to **closed**.

Finding 7: 2011 TBD does not adequately cover environmental doses

- ◆ 7/22/2019: NIOSH issued a white paper addressing finding 7 (environmental dose).
- ◆ SC&A evaluated NIOSH's white paper concerning finding 7 and analyzed the data that were used to derive the recommended annual environmental intakes for the various time intervals during the period 1958–2011.
- ◆ SC&A issued an evaluation report 11/18/2019. The following is a summary of SC&A's analysis.

Finding 7: SC&A's analysis of uranium environmental intakes

- ◆ SC&A analyzed the method and data used to derive the annual uranium environmental intake values as listed in table 7 of the white paper for the period 1958–2011.
- ◆ SC&A concurs with the methods used and the results.

Finding 7: SC&A's analysis of plutonium environmental intakes

- ◆ SC&A analyzed the method and data used to derive the annual plutonium environmental intake values as listed in table 6 of the white paper for the period 1965–1978.
- ◆ SC&A concurs with the methods used and the results.

Finding 7: SC&A's analysis of external environmental doses

- ◆ SC&A analyzed the method and data used to derive the annual external environmental doses as listed in table 15 of the white paper for the period 1965–2011.
- ◆ SC&A concurs with the methods used and the results.

Finding 7: Resolution and closure

- ◆ 1/30/2020: The finding was discussed during the WRG WG teleconference.
- ◆ The WG found the finding satisfactorily addressed and the issues resolved.
- ◆ The WG **closed** the finding.

Secondary finding A: TBD tables based on 365 days instead of 250 days

- ◆ TBD tables 3-15, 5-2, and 5-3 are based on 365 days instead of 250 days per year.
 - 8/3/2015: The finding was discussed at the WRG WG teleconference. The tables are correct if the dose reconstruction applies the intake values for 365 days per year.
 - 1/30/2020: NIOSH stated at the WRG WG teleconference that it would revise the WRG TBD to reflect changes necessary to clarify this issue. The WG **closed** the finding.

Secondary finding B: AEC material

- ◆ Atomic Energy Commission (AEC) material buried and removed from ponds and grounds not documented or accounted for.
 - 8/3/2015: This secondary finding was discussed at the WRG WG teleconference.
 - 1/30/2020: NIOSH stated during the teleconference that it would revise the WRG TBD to reflect changes necessary to clarify the issue. The WG **closed** this finding.

Secondary finding C: Burial grounds workers and definition issue

- ◆ 8/3/2015: This secondary finding was discussed at the WRG WG teleconference.
- ◆ 1/30/2020: NIOSH stated that it would revise the WRG TBD to reflect changes necessary to clarify this issue. The WG **closed** the finding.

Secondary finding D: Methods used to derive table 5-5 not provided

- ◆ 8/3/2015: This finding was discussed at the WRG WG teleconference.
- ◆ SC&A evaluated NIOSH's white paper concerning finding 7 (environmental external dose section). SC&A verified the revised calculations for beta dose on page 26 and the entries in table 16 of the white paper.

Secondary finding D: Resolution and closure

- ◆ 11/18/2019: SC&A evaluation report concurs with the methods used and the derived dose values in this section of the white paper.
- ◆ 1/30/2020: The finding was discussed during the WRG WG teleconference. NIOSH will incorporate the revised external dose data into the revised WRG TBD. The WG **closed** the finding.



Questions?