

## Site Profile Issues Resolution for W. R. Grace & Company in Erwin, Tennessee

This document updates the August 2015 version of the site profile issues matrix for W. R. Grace & Company (WRG) in Erwin, TN (SC&A, 2015). These issues originally appeared in SC&A’s (2013) review of the WRG technical basis document (TBD), ORAUT-TKBS-0043, revision 02, “An Exposure Matrix for W.R. Grace and Company in Erwin, Tennessee” (2011a).

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**Finding 1**

Author, date	Response
SC&A initial finding, January 2013	<p><b>Accuracy and completeness of bioassay records not addressed.</b></p> <p>The accuracy and completeness of the recorded bioassay data have not previously been addressed by either the U. S. Department of Energy (DOE) or National Institute for Occupational Safety and Health (NIOSH) as part of a routine “verification and validation” (V&amp;V) database review. SC&amp;A performed a preliminary scan of the WRG DOE files for a small sampling of claimants and did not identify any outstanding issues. However, a broader and more detailed survey should be conducted that would determine if workers who should have been monitored because of job title (i.e., chemical operator, production-line operator, etc.) and/or location (i.e., production buildings, waste facilities, burial grounds, etc.) have recorded bioassay data for the corresponding periods when working in these areas.</p>
NIOSH, January 2013	<p>The available bioassay data was extensively reviewed by NIOSH both for development of the TBD [technical information bulletin] and evaluation of the SEC [Special Exposure Cohort] petition, although there are a number of additional claims added since that time.</p> <p>NIOSH agrees that data review and analysis needs to be completed for the adequacy of claimant uranium bioassay data during the period of burial ground remediation. The review should focus on job titles, work locations and bioassay data to determine if those who should have been monitored based on job responsibilities were monitored.</p> <p>Derived default intakes for uranium for the operational and residual period currently exist and are based on actual air concentration data at WR Grace during the operational period, so no further development of a uranium coworker model is necessary. Based on NOCTS records, uranium bioassay began in late 1964, and it is quite extensive in claimant records from that point, with few exceptions. No bioassay has been found prior to that date, so it is already known to be deficient prior to late 1964. Default intakes are provided in the TBD for unmonitored periods. The TBD also provides default intakes that are to be used for the residual contamination period, with the exception for workers performing remediation of the burial grounds. Other than the period of burial ground remediation, review of adequacy of claimant uranium bioassay data is not needed or useful.</p> <p>Plutonium bioassay data is available for some workers starting in 1967. The available plutonium bioassay data will be reviewed and intakes are to be assessed (see Finding #3 response).</p> <p>Thorium bioassay data is not available for claimants, nor known to exist, during the AWE [Atomic Weapons Employer] period, which is the basis for the SEC, from 1958-1970. Therefore, additional review of claimant data for thorium bioassay data is not needed.</p>

Author, date	Response
SC&A, August 2015	SC&A agreed that NIOSH's approach is reasonable and will evaluate the data and recommended method(s) when they are available (SC&A, 2015).
Uranium Refining Atomic Weapons Employers (URAWE) Work Group (WG) teleconference, August 3, 2015	The WG discussed the finding during the teleconference (URAWE WG, 2015).
NIOSH, August 28, 2019	NIOSH issued a white paper addressing finding 1 (NIOSH, 2019a). There were 3 claims yet to be resolved.
SC&A, November 19, 2019	SC&A evaluated NIOSH's white paper (NIOSH, 2019a) concerning V&V of the accuracy and completeness of the recorded bioassay data (SC&A, 2019a). SC&A found that NIOSH's analysis of all the WRG claimant bioassay data in the NIOSH DCAS Claims Tracking System (NOCTS) was inclusive and covered the many time periods at the various facilities for the uranium and plutonium radionuclides of concern. In general, workers were bioassayed. For workers who should have been, but were not, monitored, NIOSH provided coworker or environmental intakes for dose reconstruction purposes in its responses to finding 3 (NIOSH, 2019b), findings 2 and 7 (NIOSH, 2019c), and in revision 02 of the TBD (NIOSH, 2011a).  SC&A's review of the white paper on finding 1 found that NIOSH's response and recommendations concerning the finding were reasonable and verifiable. SC&A had no findings in this review. NIOSH has three claimants for which addition information from the site is required.
URAWE WG teleconference, January 30, 2020	NIOSH made a presentation concerning WRG finding 1 that included resolution of the three remaining claimant files (two claimants' files located and the third claimant was compensated using other records). The WG discussed the finding and found it to be satisfactorily addressed and the issues resolved. <b>The WG closed the finding.</b>

## Finding 2

Author, date	Response
SC&A initial finding, January 2013	<p><b>Insufficient uranium bioassay/intake data.</b></p> <p>If a worker’s uranium bioassay data are not available, the TBD recommends on page 25 that the intake values in Table 3-15 be used to assign unmonitored dose during the operational period 1958–1970. There has been no documentation or substantiation of 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.</p>
NIOSH, January 2013	<p>The methodology in the TBD provides a claimant favorable approach, as described below.</p> <p>The <math>1.71 \times 10^3</math> pCi/day [picocurie/day] uranium inhalation intake in Table 3-15 of the TBD is based on exposure to an air concentration of 578.38 dpm/m<sup>3</sup> [disintegrations per minute per cubic meter] for 2,000 hours per year. The air concentration is the 95<sup>th</sup> confidence level of the 1961 breathing zone (BZ) samples from SRDB [Site Research Database] Ref ID 11771, as shown in TBD Table 3-8. It is used to calculate an upper bound internal exposure during the operational period. This is the basis for the default uranium intakes that are assigned during the operational period (1958-1970) for usage only if no uranium bioassay exists for an EE.</p> <p>SRDB Ref ID 11771 also has results from November 1959 airborne dust surveys during operations at WR Grace. It states “Only two operations produce significant dust concentrations. The average concentration at digester charging, an unventilated operation, is 170 dpm/m<sup>3</sup>. The average concentration at the dry box operation is 280 dpm/m<sup>3</sup>.”</p> <p>The BZ sample results from the 1959 and 1961 surveys were not personal air samplers and are not directly representative of average worker exposures. However, both the 1959 and 1961 survey reports also included estimates of the workers’ average daily weighted exposures. The maximum reported average daily weighted worker exposures from those two studies was 170 dpm/m<sup>3</sup>. The various results are shown in Tables 3-4 through 3-9 of the TBD.</p> <p>NIOSH agrees with SC&amp;A’s comment that the use of the single default intake value in the TBD is not representative of all exposures; however, given the limited data available and the uncertainty in selecting an appropriate value for a particular dose reconstruction, the assumption of 1.71E+3 pCi/d inhalation intake in Table 3-15 is a claimant favorable realistic bounding intake for operators. Further evaluation would not likely result in a higher default bounding intake. However, NIOSH will evaluate the intakes in Table 3-15 to provide more realistic intakes for those workers who would not have been routinely exposed to such high levels of uranium.</p>
SC&A, August 2015	<p>SC&amp;A’s current review of the data indicates that this is a reasonable approach considering the data available, and it was during the SEC period. SC&amp;A will evaluate any additional changes to Table 3-15 when they become available.</p>

Author, date	Response
URAWG WG teleconference, August 3, 2015	The WG discussed the finding during the teleconference (URAWG WG, 2015).
NIOSH, July 22, 2019	NIOSH issued a white paper addressing finding 2 (NIOSH, 2019c).
SC&A, November 18, 2019	<p>SC&amp;A evaluated NIOSH’s white paper on finding 2 (NIOSH, 2019c). The following is a summary of SC&amp;A’s (2019b) evaluation:</p> <ul style="list-style-type: none"> <li> <p><b>AWE operational period intakes (1958–1970)</b> – During the meeting on August 3, 2015, of the URAWG WG, NIOSH provided the rationale for the default uranium intake in table 3-15 (p. 26) of the TBD. The WG discussed the issue and concurred with NIOSH’s approach, but, since it was a bounding approach, the WG recommended NIOSH provide further breakdown of the intakes by work categories.</p> <p>SC&amp;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” (NIOSH, 2011b), and concurs with the intake values listed in table 1 (p. 6) of the white paper for the operational period.</p> </li> <li> <p><b>Residual contamination period intakes (1971–March 1, 2011)</b> – SC&amp;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 (pp. 7 and 8) of the white paper for the residual period. SC&amp;A concurs with the methods used and the derived intake values in this section of the white paper.</p> </li> </ul>
URAWG WG teleconference, January 30, 2020	SC&A made a presentation about WRG finding 2 and concurred with NIOSH’s methods and resulting data. The WG discussed the finding and found it satisfactorily addressed and the issues resolved. <b>The WG closed the finding.</b>

### Finding 3

Author, date	Response
SC&A initial finding, January 2013	<p><b>Use of operational-period plutonium results but not residual-period plutonium results, and not estimating non-bioassayed workers' plutonium doses during either period, are not consistent with the Special Exposure Cohort (SEC).</b></p> <p>The SEC was <b>not</b> based on lack of plutonium data, and it has not been documented that plutonium was not Atomic Energy Commission (AEC) weapons-related (and indications are that it could have been, in any case). Therefore, plutonium dose reconstruction (DR) during the <b>operational period</b> should be included in the DR protocol, as it was for uranium, with provisions (such as using a coworker model) to bridge gaps in bioassays, or to compensate for lack of bioassays.</p> <p>Additionally, not assigning plutonium dose during the <b>residual period</b> assumes that all legacy plutonium from the operational period is still undisturbed in storage, burial grounds, ponds, buildings, duct work, etc., and creates no significant exposure hazard. However, this is not the situation during the residual period. Therefore, it appears that to substantiate that plutonium processed at WRG was <b>not</b> used in the AEC weapons program (and hence not to be included in the residual period as recommended in the TBD), NIOSH would need to locate government documents outside of the WRG/Nuclear Fuels Services (NFS) company that would verify the origin, destination, and ultimate use of the plutonium material processed at the WRG facility during the operational period.</p>
NIOSH, January 2013	After additional review of the scope of the plutonium work at W. R. Grace, NIOSH concludes that dose received from plutonium work at W.R. Grace should be included in dose reconstructions. Therefore, an assessment of plutonium exposures from both the AWE and the residual contamination periods will be performed for a revision to the TBD in order to determine an appropriate methodology and if data capture efforts are needed. This methodology will assess the quantity of plutonium processed in order to evaluate unmonitored exposures, as well as reviewing existing claims with plutonium bioassay.
SC&A, August 2015	SC&A agrees that this approach is reasonable and will evaluate the data and recommended method(s) when they are available.
URAWE WG teleconference, August 3, 2015	The WG discussed the finding during the teleconference (URAWE WG, 2015).
NIOSH, March 1, 2019	NIOSH issued a white paper addressing finding 3 (NIOSH, 2019b).

Author, date	Response
SC&A, August 30, 2019	<p>SC&amp;A evaluated NIOSH’s white paper (NIOSH, 2019b) for finding 3. SC&amp;A’s (2019c) evaluation of the white paper found that NIOSH used the recommended methods, per approved appropriate procedural documents, to derive reasonable coworker data from the available recorded bioassay and air monitoring data. SC&amp;A did not identify any findings but did have three observations:</p> <ul style="list-style-type: none"> <li>• Observation 1: Extension of 1967 data to include 1965 and 1967</li> <li>• Observation 2: Use of 30 percent and 3.9 percent factor unclear</li> <li>• Observation 3: Were in vivo bioassays required or performed for decontamination and decommissioning (D&amp;D) workers?</li> </ul>
URAWG WG teleconference, January 30, 2020	<p>NIOSH made a presentation concerning WRG finding 3 and presented resolution of the previous three SC&amp;A observations (SC&amp;A, 2019c):</p> <ol style="list-style-type: none"> <li>1. Plutonium inventory was much less in 1965 &amp; 1966 than in years bioassays were available; therefore, extension of 1967 data to 1965 &amp; 1966 is reasonable.</li> <li>2. The difference in the plot data and the table data is due to adjustment of 365 day to 250 days, as SC&amp;A has indicated.</li> <li>3. Although the wording is not clear in the quoted document, NIOSH found urine, fecal, and in vivo data during the D&amp;D phase.</li> </ol> <p>The WG discussed the finding and found it to be satisfactorily addressed and the issues resolved. <b>The WG closed the finding.</b></p>

#### Finding 4

Author, date	Response
SC&A initial finding, January 2013	<p><b>Lack of neutron dose assignment.</b></p> <p>SC&amp;A did not locate any recorded neutron doses in the claimants’ files reviewed to date. The TBD concludes (p. 28) that there were potential neutron exposures, but “No attempt should be made to estimate neutron dose for workers not monitored for neutrons during the operational period.” Site profiles for other uranium- and plutonium-handling facilities incorporate neutron doses in the DR process, usually using the neutron-to-photon ratio (N:P) method, for workers potentially exposed to neutrons. Further investigation of the potential neutron exposures and methods to assign appropriate neutron doses is needed for the WRG facility.</p>

Author, date	Response
NIOSH, January 2013	NIOSH agrees that further investigation is necessary. The timeframe for when neutrons are assigned to be based on the results of the assessment of plutonium exposures from both the AWE and the residual contamination periods, (1958-March 1, 2011) from Issue #3. The N:P ratio(s) from the assessment can be used to estimate neutron dose from the WR Grace source term.
SC&A, 2015	SC&A agrees that this approach is reasonable and will evaluate the data and recommended method(s) when they are available.
URAWE WG teleconference, August 3, 2015	The WG discussed this finding the teleconference (URAWE WG, 2015).
NIOSH, May 1, 2017	NIOSH issued a white paper addressing finding 4 (NIOSH, 2017).
SC&A, September 26, 2017	<p>SC&amp;A evaluated NIOSH's white paper addressing finding 4 (NIOSH, 2017) and presented the results in a memorandum to the URAWE WG (SC&amp;A, 2017a). In the white paper, NIOSH analyzed the N:P ratios at other DOE sites that processed plutonium in a similar manner and of similar composition as at WRG.</p> <p>SC&amp;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&amp;A (2017b) had reviewed revision 03 to the NUMEC site profile and concurred with NIOSH's recommended N:P ratio geometric mean value of 0.34 for non-glovebox workers and N:P ratio geometric mean value of 1.00 for glovebox workers at NUMEC.</p> <p>However, SC&amp;A did not find that NIOSH's recommendations for the determination of potential plutonium exposure (as provided in the last paragraph on page 6 of NIOSH (2017) to be applicable or adequate. None of these items are applicable at WRG because there was no significant neutron monitoring before, during, or after the processing of plutonium at WRG, and detailed photon dosimetry calibration information is not available for WRG. Although the plutonium fuel was similar in composition, the facility layout and scale of operation were different at WRG from those at the Savannah River Site (SRS). Therefore, the recommendations for SRS in OCAS-TIB-007, revision 01 (NIOSH, 2007), are not very useful for application at WRG.</p> <p>Unless there are consistent DOE records for WRG workers indicating that they have worked, or not worked, with plutonium, it may be necessary to assign neutron dose to each production worker in buildings 234 and 110 during the plutonium production era (1965–1972), unless the worker's record indicates otherwise.</p> <p>Additionally, potential for neutron exposure from plutonium needs to be addressed during the standby (storage) phase (1973–1987) and during the decontamination phase (1987–1994) for workers involved in those operations. Neutron exposures from uranium (as discussed in the WRG TBD, p. 28) were not included in NIOSH's white paper and have yet to be addressed.</p>

Author, date	Response
URAWE WG teleconference, January 30, 2020	<p>SC&amp;A made a presentation concerning WRG finding 4 and concurred with NIOSH's methods and resulting N:P ratio values. However, SC&amp;A presented three areas of concern: (1) the selection of workers that would be assigned neutron dose from plutonium exposures, (2) the assignment of neutron dose during other periods, and (3) neutron dose assignment from uranium exposures, as discussed in the WRG TBD, p. 28.</p> <p>During the call, NIOSH addressed SC&amp;A's three areas of concern as follows:</p> <ol style="list-style-type: none"> <li>1. NIOSH will use worker categories to assign neutron dose, not the SRS method suggested in the white paper.</li> <li>2. NIOSH has neutron monitoring requirements and data for the D&amp;D phase.</li> <li>3. NIOSH will provide methods and data to assign neutron dose from uranium as was briefly indicated in the WRG TBD, p. 28.</li> </ol> <p>NIOSH will revise the TBD to reflect these three issues and their resolutions.</p> <p>The URAWE WG discussed the finding and found it to be satisfactorily addressed and the issues resolved. <b>The WG closed the finding.</b></p>

## Finding 5

Author, date	Response
SC&A initial finding, January 2013	<p><b>Lack of dosimetry calibration knowledge.</b></p> <p>Because of the lack of information indicating otherwise, it appears that the dosimeters for WGR workers were read and recorded by outside vendors, with WRG depending on the processing companies to provide the correct correlation between the various radiation fields at WRG and the vendor's calibration. It needs to be determined if any field measurements of the radiation energy spectra were made, and what calibration source(s) were used by the vendors. Dosimeters calibrated using higher-energy sources, such as cobalt-60, may not have correctly responded to the lower-energy photons from the various radionuclides present at WRG. Therefore, a correction factor may be needed, especially for determining the dose to skin and shallow organs.</p>
NIOSH, August 2015	<p>It is agreed that there is limited information in the SRDB to address this finding. SRDB Ref ID: 23570 provides general Landauer information and the accuracy of the Landauer results are assumed to be sufficient for calculating doses. No additional data capture efforts are necessary.</p>

Author, date	Response
SC&A, August 2015	<p>SC&amp;A recently performed searches on the SRDB and did not locate additional relevant information concerning dosimetry calibration.</p> <p>SC&amp;A will contact Landauer in an attempt to determine the calibration of WRG badges during the earlier periods at WRG.</p> <p>NIOSH will perform a brief evaluation of several claimants' external dose trends during the transition time between Nuclear Chicago and Landauer.</p> <p>This issue still remains open.</p>
URAWG WG teleconference, August 3, 2015	The WG discussed this finding during the teleconference (URAWG WG, 2015).
NIOSH, August 25, 2015	A few claims were reviewed by NIOSH 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.
SC&A, March 18, 2016	SC&A requested a copy of NIOSH's review of the claims and evaluated the results. SC&A found that during the period 1958–1963 for these four EEs, the external doses did not show any abnormalities that would indicate changes in dosimeter calibration or recording procedures.
SC&A, March 21, 2016	<p>SC&amp;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&amp;A did not find definitive data but found that, while Landauer did not report doses for different energy ranges, they would report the dose as nonpenetrating if the surface dose was greater than 5 times the deep dose; e.g., for plutonium exposures.</p> <p>SC&amp;A does not find indications that future research would significantly alter the external doses assigned and suggests closing this issue.</p>
URAWG WG meeting, July 19, 2016	This issue was <b>closed</b> during the July 19, 2016, URAWG WG meeting.

## Finding 6

Author, date	Response
SC&A initial finding, January 2013	<p><b>Onsite medical x-ray exams not substantiated.</b></p> <p>It has not been substantiated that x-ray exams were performed onsite at the WRG facility during the AEC operational period of 1958–1970. Therefore, assigning offsite x-ray exams may not be consistent with ORAUT-OTIB-0079, revision 00 (NIOSH, 2011c), if the exams were performed offsite. While the TBD recommendations are claimant favorable, to ensure consistency with other site profiles, this is an area that needs further verification.</p>
NIOSH, January 2013	<p>We have no definitive information of where occupational medical X-rays were taken during the operational period, (1958-1970). However, NIOSH does not believe that additional research or further verification is necessary. ORAUT-OTIB-0079 [NIOSH, 2011c], directs us to assume that X-rays were performed on site until substantive evidence exists to show otherwise.</p> <p>We currently have limited information regarding occupational medical X-rays for WR Grace, Erwin, Tennessee. SRDB Reference ID 11775, p. 5 of a Nuclear Safety Review (unknown year, but Davison era), indicates that a physician is utilized for the medical program at WR Grace which includes pre-employment, annual and termination physicals, for which the physicals include a pre-employment X-ray, but not for annual X-rays. SRDB Reference ID 41325, p. 8 (Worker Outreach Meeting from 2005) – discusses that annual PA chest X-rays were performed in the early years.</p> <p>Due to the limited amount of information, the claimant favorable defaults established by the project are appropriate. The defaults are the assumption of annual PA chest X-rays during the operational period, (e.g., January 1, 1958 - December 31, 1970). Because these are claimant favorable assumptions, no further action should be necessary.</p> <p>Additionally, in order to provide clarification, it is recommended that the following be addressed in the next TBD revision:</p> <ol style="list-style-type: none"> <li>1. SRDB Reference ID 11775, pg. 5 states that pre-employment, annual and termination physicals were done. However, it also states that x-rays were NOT taken at the annual physical. This does not appear to have been included in the TBD.</li> <li>2. Although the TBD references OTIB 79, the TBD should state that the x-rays are assumed to have been performed on site per the direction in OTIB 79, since no evidence to the contrary exists. See #3 below, though. The TBD cites OTIB 79 as a justification for assigning X-rays, but makes no mention of onsite or offsite.</li> <li>3. Include references not currently cited. For example, the worker outreach meeting from April 2011, SRDB Reference ID# 117711, p. 20 is not referenced in the TBD published in Sept. 2011.</li> </ol>

Author, date	Response
SC&A, August 2015	<p>While SC&amp;A agrees that NIOSH recommendation is claimant favorable, SRBD Ref ID 117711, PDF page 20, second paragraph states: “After some discussion, the attendees agreed that X rays are done annually at the hospital in Erwin...”</p> <p>However, since the time period was not certain, and SC&amp;A could not locate any documented evidence that x-rays were taken off site; SC&amp;A agrees that ORAUT-OTIB-0079 recommendations for unconfirmed status would apply here, and recommends closure of this issue</p>
URAWE WG teleconference, August 3, 2015	This finding was discussed during the URAWE WG teleconference (URAWE WG, 2015). <b>The WG closed this finding.</b>

## Finding 7

Author, date	Response
SC&A initial finding, January 2013	<p><b>The 2011 TBD does not adequately cover environmental doses.</b></p> <p>The methods for estimating dose in the TBD do not account for airborne radioactive materials that were generated by the cleanup and processing of waste from the ponds and burial grounds during the residual period to which monitored, as well as unmonitored, non-burial ground workers may have been exposed. These non-burial grounds workers may still have been exposed to environmental radioactive materials from the cleanup operations during the residual period.</p> <p>The internal and external environmental exposures throughout the site during both the AEC period (1958–1970) and from the cleanup of the AEC legacy materials during the period 1971–present are not adequately addressed.</p>

Author, date	Response
NIOSH, August 2015	<p>For the operational period (1958-1970), it is reasonable to continue reconstructing doses based on available bioassay results and to assign default uranium intakes per Section 3.4 of the TBD for unmonitored uranium workers. Section 6 of the TBD, is considered to be appropriate: “It is not necessary to include an environmental dose component for W.R. Grace worker dose because all workers are assumed to have been exposed to operational conditions, and dose has been assigned accordingly.” (Also refer to response to finding 2 on derivation of uranium default intakes and response to finding 3 on not needing a plutonium coworker model for unmonitored plutonium workers). Additionally, the operational period (1958-1970) has a SEC for thorium.</p> <p>Data capture efforts are recommended in order to properly address this finding for the remediation portion (1991-March 2011), of the residual period at WR Grace. Workers (in their interviews) indicate that both lapel SRDB Ref ID: 98196 and boundary air samples were taken SRDB Ref ID: 98200 and 117711 in 400 and 410 where the remediation was done. The main two buildings used in the Ponds 1, 2, 3, 4 and the Burial ground D&amp;D work were the 400 and the 410 Buildings. Therefore, data capture efforts are needed to include all survey and air data post 1990 for 400 and 410 buildings and/or ponds/burial grounds areas to determine if the derivation of environmental doses are warranted.</p>
SC&A, August 2015	SC&A agrees that this approach is reasonable and will evaluate the data and recommended method(s) when they are available.
URAWE WG teleconference, August 3, 2015	The WG discussed this finding during the teleconference (URAWE WG, 2015). SC&A will evaluate any additional changes to table 3-15 when they become available.
NIOSH, July 22, 2019	NIOSH issued a white paper addressing finding 7 (NIOSH, 2019c).

Author, date	Response
SC&A, November 18, 2019	<p>SC&amp;A evaluated NIOSH’s (2019c) white paper for finding 7 as follows (SC&amp;A, 2019b).</p> <p><b>Environmental Intakes:</b> SC&amp;A analyzed the data NIOSH used to derive the recommended annual environmental intakes for the various time intervals during the period 1958–2011, with the following results:</p> <ul style="list-style-type: none"> <li>• Environmental air monitoring data (1979–2011) – SC&amp;A analyzed the data used to derive the annual average perimeter gross alpha concentrations in table 3 (p. 13) for the period 1979–1995 and the conversion to the recommended environmental alpha intake rates (dpm/d) in table 4 (p. 14) for 1979–2011. SC&amp;A concurs with the methods used and the derived intake values recommended in this section of the white paper.</li> <li>• Environmental uranium intakes (1958–1970) – SC&amp;A analyzed the method and data used to derive the annual operational-period clerical inhalation intake of 95 dpm/d, listed in table 1 (p. 6) for 1958–1970. SC&amp;A concurs with the results.</li> <li>• Environmental uranium intakes (1971–1978) – SC&amp;A performed an exponential decrease of the 1970 operational-period clerical intake (95 dpm/d) down to the 1979 environmental intake of 2.31 dpm/d. The results of the calculations and intake values were the same as those summarized in table 5 (p. 15) for 1971–1978. SC&amp;A concurs with the methods used and the derived intake values in this section of the white paper.</li> <li>• Environmental plutonium intakes (1965–1978) – SC&amp;A verified that the recommended annual environmental intake values for plutonium, as listed in table 6 (p. 16) for this period, were derived by using the clerical rate of 5 percent of the intake values listed in table 8 (p. 13) and table 9 (p. 13) of NIOSH (2019b). SC&amp;A has previously reviewed NIOSH’s white paper concerning plutonium and concurs with the results (SC&amp;A, 2019c).</li> </ul> <p>While SC&amp;A concurs with the methods used and the values derived for environmental internal intakes in NIOSH’s response to finding 7, SC&amp;A did have the following observation:</p> <p><b>Observation 1: Organized and concise recommendations to dose reconstructors needed.</b> SC&amp;A found the “Intake Summary” section in the white paper (pp. 16–20) lacked organization and concise recommendations for the dose reconstructor’s use. This is especially apparent in the “Environmental Intakes” and “Dose Reconstruction Notes” subsections on pages 19 and 20 of the white paper. This lack of organization could result in errors and inconsistencies in DR by different dose reconstructors.</p> <p><b>Environmental External Exposures:</b> SC&amp;A analyzed the environmental thermoluminescent dosimeter and burial grounds information and concurs with the methods used and the derived dose values in this section of the white paper and the annual dose rate values listed for the general environment and for the burial grounds in table 15 (p. 25).</p>

Author, date	Response
URAWE WG teleconference, January 30, 2020	During the teleconference, NIOSH made a presentation on WRG finding 7. The WG discussed the finding NIOSH will revise the WRG TBD to address the organizational issues raised by SC&A's observation. The WG found the finding satisfactorily addressed and the issues resolved. <b>The WG closed the finding.</b>

## Secondary Finding A

Author, date	Response
SC&A initial finding, January 2013	<p><b>Table 3-15, Table 5-2, and Table 5-3 based on 365 days instead of 250 days per year.</b></p> <p>SC&amp;A found that Tables 3-10 and 3-11 on page 22 of the TBD are based on 250 days/year (i.e., 2,000 hours/year × 1 day/8 hours = 250 days/year); However, Table 3-15 on page 26, Table 5-2 on page 33, and Table 5-3 on page 34 are all based on 365 days/year, but use the data from Tables 3-10 and 3-11 that are based on 250 days/year. Therefore, the values in Table 3-15, Table 5-2, and Table 5-3 are too small by a factor of 365/250 = 1.46, and need to be revised upward in value by a factor of 1.46 to be correct.</p>
NIOSH, January 2013	<p>NIOSH has reviewed the calculations. The intake rates in Tables 3-15 and 5-2 are normalized to a calendar day intake rate based on an air concentration of 578.38 dpm/m<sup>3</sup>.</p> $578.38 \text{ dpm/m}^3 \times \text{pCi}/2.22 \text{ dpm} \times 1.2 \text{ m}^3/\text{hr} \times 2000 \text{ hr/yr} \times 1\text{yr}/365 \text{ d}$ $= 1.71 \times 10^3 \text{ pCi/d}$ <p>Likewise, Table 5-3 is also a calendar day intake basis. So it appears that no adjustment is needed in the current TBD. However, in the next TBD revision, NIOSH will add footnotes to the tables to indicate that the values are normalized to calendar day rates.</p>
SC&A, August 2015	This is correct if the DR applies the intake values for 365 days per year. However, it seems unnecessary to create this complication because most intake tables are for 250 work days, not 365 calendar days (especially since the use of 250 days per year is stated on page 32 when referring to Table 3-15, from which this data is obtained). SC&A will evaluate the text and tables when the revision is available.
URAWE WG teleconference, August 3, 2015	The URAWE WG discussed this secondary finding during the teleconference (URAWE WG, 2015). Status changed to in progress.

Author, date	Response
URAWE WG teleconference, January 30, 2020	During the teleconference, NIOSH stated that it would revise the WRG TBD to reflect changes necessary to clarify these issues. <b>The WG closed this secondary finding.</b>

## Secondary Finding B

Author, date	Response
SC&A initial finding, January 2013	<b>AEC material buried and removed from ponds and grounds not documented or accounted for.</b> SC&A has not found sufficient documentation of the materials that were buried and then removed from the ponds, burial grounds, and trenches to allow for the determination of the potential exposure to workers, especially the ability to separate the AEC legacy weapons/research-related materials from the other materials. Although it is stated on page 31 of the TBD that, “The contents and locations of most disposal pits are well documented,” there are no references provided.
NIOSH, January 2013	Workers involved with the remediation of the ponds/burial grounds were assumed to have been on a bioassay program and monitored accordingly. Therefore, in those cases we would assess the bioassay data and assign dose accordingly. The residual intakes would only be used to limit bioassay for non- remediation workers.  Additional data capture efforts are needed to determine if bioassay for all radionuclides was performed, or if only primary radionuclide (uranium) was monitored for and if we should be associating radionuclides to that. In general, the contents of the AEC material buried and removed from the ponds and grounds requires further evaluation.
SC&A, August 2015	SC&A will evaluate the data and changes when they are available.
URAWE WG teleconference, August 3, 2015	The WG discussed this secondary finding during the teleconference (URAWE WG, 2015). Status changed to in progress.
URAWE WG teleconference, January 30, 2020	During the teleconference, NIOSH stated that it would revise the WRG TBD to reflect changes necessary to clarify these issues. <b>The WG closed this secondary finding.</b>

### Secondary Finding C

Author, date	Response
SC&A initial finding, January 2013	<b>Burial Grounds workers and definition issue.</b> Because many workers changed job locations/duties frequently (an “operator” at WRG could be doing anything from mixing chemicals, pressing pellets, digging a ditch, or operating a bulldozer), it would be difficult for the dose reconstructor to determine if a specific worker was involved in burial grounds activities. Also, it is not clear if the term <i>Burial Grounds</i> includes the trenches and ponds, where a large of amount of the cleanup took place in the residual period, or just the North Burial site, as indicated in Figure 2-2 of the TBD.
NIOSH, January 2013	It is agreed that the definition of “Burial Grounds Workers” should be provided in the next TBD revision.
SC&A, August 2015	SC&A will evaluate these changes when they are available.
URAWE WG teleconference, August 3, 2015	The WG discussed this secondary finding during the teleconference (URAWE WG, 2015). Status changed to in progress.
URAWE WG teleconference, January 30, 2020	During the teleconference, NIOSH stated that it would revise the WRG TBD to reflect changes necessary to clarify these issues. <b>The WG closed this secondary finding.</b>

### Secondary Finding D

Author, date	Response
SC&A initial finding, January 2013	<b>Methods used to derive Table 5-5 not provided.</b> External annual exposure rates for the residual period (1971–present) are provided on page 36 of the TBD. Presumably, the data in this table were derived from the maximum DWE [daily weighted exposures] of 578 dpm/m <sup>3</sup> coupled with the average depletion rate of 0.00067/day from Table 5-1. However, it is not stated how the values in Table 5-5 were calculated; i.e., what resuspension rate was used, how the penetrating versus non-penetrating doses were derived, or whether rather this residual contamination is on the floor, work surfaces, ground, etc., and if this includes components of RU [recycled uranium].
NIOSH, January 2013	Further information on the methods used to derive the Table 5-5 TBD values should be documented in the next TBD revision to explain what we did.
SC&A, August 2015	SC&A will evaluate these changes when they are available.

Author, date	Response
URAWG WG teleconference, August 3, 2015	The WG discussed this secondary finding during the teleconference (URAWG WG, 2015). SC&A will evaluate the text and tables when the revision is available. Status changed to in progress.
SC&A BRS entry, January 2, 2020	SC&A evaluated (SC&A, 2019b) NIOSH’s white paper “NIOSH Resolution of W. R. Grace Site Profile Findings 2 and 7,” (NIOSH, 2019c). SC&A verified the revised calculations for beta dose on page 26 and the entries in table 16 (p. 27) of the white paper, using the updated methods to calculate the annual beta doses from residual contamination as recommended in Battelle-TBD-6000 (NIOSH, 2011b). SC&A concurs with the methods used and the derived dose values in this section of the white paper.
URAWG WG teleconference, January 30, 2020	The WG discussed this secondary finding during the teleconference. The revised external dose data given in the NIOSH white paper (NIOSH, 2019c) addressing finding 2 and 7 will be incorporated into the revised WRG TBD. <b>The WG closed this secondary finding.</b>

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