

ISSUES RESOLUTION MATRIX FOR WR GRACE & COMPANY in Erwin, Tennessee SITE PROFILE

Finding Number	Report Section	Finding Description	NIOSH Response
1	3	<p>Accuracy and completeness of bioassay records not addressed.</p> <p>The accuracy and completeness of the recorded bioassay data have not previously been addressed by either DOE or NIOSH as part of a routine “verification and validation” (V&V) database review. SC&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>	<p>The available bioassay data was extensively reviewed by NIOSH both for development of the TBD and evaluation of the SEC 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 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>

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2		<p>Insufficient uranium bioassay/intake data. 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>	<p>The methodology in the TBD provides a claimant favorable approach, as described below.</p> <p>The 1.71×10^3 pCi/day uranium inhalation intake in Table 3-15 of the TBD is based on exposure to an air concentration of 578.38 dpm/m³ for 2,000 hours per year. The air concentration is the 95th confidence level of the 1961 breathing zone (BZ) samples from <u>SRDB Ref ID 11771</u>, 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><u>SRDB Ref ID 11771</u> 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/m³. The average concentration at the dry box operation is 280 dpm/m³.”</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/m³. The various results are shown in Tables 3-4 through 3-9 of the TBD.</p> <p>NIOSH agrees with SC&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>
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3	<p>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).</p> <p>The SEC was not based on lack of plutonium data, and it has not been documented that plutonium was not AEC weapons-related (and indications are that it could have been, in any case). Therefore, plutonium DR during the operational period 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. Additionally, not assigning plutonium dose during the residual period 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 not 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/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>	<p>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.</p>
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4	<p>Lack of neutron dose assignment.</p> <p>SC&A did not locate any recorded neutron doses in the claimants' files reviewed to date. The TBD concludes (page 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>	<p>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 NP ratio(s) from the assessment can be used to estimate neutron dose from the WR Grace source term.</p>
5	<p>Lack of dosimetry calibration knowledge.</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 Co-60, may not have correctly responded to the lower-energy photons from the various radionuclides present at WRG. Therefore, a correction</p>	<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>

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	factor may be needed, especially for determining the dose to skin and shallow organs.	
6	<p>Onsite medical x-ray exams not substantiated.</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 (ORAUT 2011d) 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>	<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, 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. <u>SRDB Reference ID 11775, p. 5</u> 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. <u>SRDB Reference ID 41325, p. 8</u> (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"> 1. <u>SRDB Reference ID 11775, pg. 5</u> 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. 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,

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			<p>though. The TBD cites OTIB 79 as a justification for assigning X-rays, but makes no mention of onsite or offsite.</p> <p>3. Include references not currently cited. For example, the worker outreach meeting from April 2011, <u>SRDB Reference ID# 117711</u>, p. <u>20</u> is not referenced in the TBD published in Sept. 2011.</p>
7		<p>The 2011 TBD does not adequately cover environmental doses.</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>	<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 <u>SRDB Ref ID: 98196</u> and boundary air samples were taken <u>SRDB Ref ID: 98200 and 117711</u> 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&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>

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<p>Secondary Finding A</p>	<p>3</p>	<p>Table 3-15, Table 5-2, and Table 5-3 based on 365 days instead of 250 days per year.</p> <p>SC&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>	<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^3.</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>
<p>Secondary Finding B</p>	<p>3</p>	<p>AEC material buried and removed from ponds and grounds not documented or accounted for.</p> <p>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.</p>	<p>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.</p> <p>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.</p>

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<p align="center">Secondary Finding C</p>	<p>Burial Grounds workers and definition issue.</p> <p>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.</p>	<p>It is agreed that the definition of “Burial Grounds Workers” should be provided in the next TBD revision.</p>
<p align="center">Secondary Finding D</p>	<p>Methods used to derive Table 5-5 not provided.</p> <p>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 of 578 dpm/m³ 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.</p>	<p>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.</p>

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