NIOSH RESPONSE: REVIEW OF REMAINING SITE PROFILE ISSUES FOR MOUND LABORATORY

Issue Number	SC&A Section	Matrix Issue Number	Issue	NIOSH/DCAS response
1	5.1	Matrix Issue #5 (PU-240, 241)	A remaining action was identified for this SEC matrix item when the Work Group closed it out: for NIOSH to confirm a bounding intake for plutonium-241 (Pu-241) for use in the dose reconstruction program. (ABRWH 2008a, Work Group (WG) transcripts pp. 147–158; ABRWH 2008b, WG transcripts, pp. 227–228). During the June 5, 2012, Work Group discussion, NIOSH (Jim Neton) agreed that this remained an open item for consideration in the then-upcoming Internal Dose TBD revision (ABRWH 2012, WG transcripts, p. 194). SC&A was unable to locate consideration of this issue within the revised TBD and suggests further clarification by NIOSH of its disposition.	NIOSH has updated Table 5-11 of the Mound internal TBD to provide bounding mixtures of Pu. The WGPu mixture with the highest proportion of Pu-241 was identified as the Hanford site mixture thus, for the current revision of the internal TBD, the Hanford mixture is used to bound Mound Pu intakes.
2	5.2	Matrix Issue #6 (Tritides)	During the Work Group discussion of this SEC issue, NIOSH acknowledged that some consideration was needed by dose reconstructors of "intermediate solubility class" tritium compounds (ABRWH 2009, WG transcripts, pp. 239–256; NIOSH 2009a). During the June 5, 2012, Work Group discussion, NIOSH (Jim Neton) agreed to address the inclusion of guidance on intermediate solubility class compounds (such as titanium tritide) in a more formal response for the Work Group (ABRWH 2012, WG transcripts, p. 198). SC&A was unable to locate any formal NIOSH response on this issue or any specific treatment within the revised TBD or in the supporting document, ORAUT-RPRT-0057, Revision 00, *A Method for Estimating Stable Metal Tritide Exposures to Tritium Ancillary Workers Based on Swipe Data in Rooms SW-8, SW13, SW-150 and R-108 at the Mound Laboratory 1968 to 1989* (Jessen et al. 2013). SC&A suggests further clarification of NIOSH's position on this item.	Assuming employment and exposure for all years (1969 – 1999), IMBA runs for solubility types F, M, and S calculated organ doses in the 1E-5 to 1E-8 rem range. This dose is significantly less than 1 millirem. The highest doses are for the thoracic lymph nodes (LN(TH)) - this was determined by assuming Type S intakes and resulted in 0.088 millirem for all potential years of exposure (or 0.000003 rem per year). NIOSH has determined that this small increment of dose does not increase probability of causation for even the most affected workers (those with respiratory-tract cancers assumed to be exposed over the entire 30-year period). Standard procedure for dose reconstruction is to use the most claimant favorable solubility type – NIOSH has not included a repetition of the standard procedure in the TBD.

3	5.3	Matrix Issue #9 (High fired Pu-238)	High-fired Pu-238	Concur with recommended closure of this site profile item.
4	5.4.1	Matrix Issues #11, 12, and 13 Uncertainties and Low Recovery for Polonium Bioassay Procedures	Uncertainty and low recovery of polonium: *Systematic errors occurred in analytical procedures in the early years due primarily to ineffective plating techniques and low recoveries. Low recoveries were due largely to colloidal plating of metabolized 238,239Pu and 210Po from raw urine onto sample containers. Polonium-210 recovery in the early years before sample acidification could have resulted in an order of magnitude correction for 210Po urinalysis results.*	Section 5.5.1.1, *Bioassay Methods*, of the current Mound TBD describes this issue in "Chemical Recovery Correction" over several paragraphs. The TBD directs dose reconstructors to use the claimant favorable methods in Section 5.8.1. The correction is described in the paragraph below: *Urinalysis data for ^{210}Po collected before 1964 should be normalized assuming 85% extraction efficiency, then corrected for a 10% chemical recovery. Polonium-210 data that was reported after 1963 should be normalized assuming 85% extraction efficiency and then corrected for a 63% chemical recovery based on the analysis by Fellman et al. (1989).* The required corrections are summarized in Equations 5-4 and 5-5, used by the dose reconstructor to reconcile the polonium urinalysis data. Note that these are the locations in the current document, but this dose reconstruction practice has been in place since the initial issue of the internal TBD for Mound in 2004.
5	5.4.2	Matrix Issues #11, 12, and 13 Other Radionuclide Data (SC&A Data Comparison)	Other Radionuclide Data This issue was raised originally in SC&A's white paper, *Mound Internal Dosimetry Data Completeness* (SC&A 2009a), in Section 3.6. In its May 2012 response (NIOSH 2012), NIOSH noted that it had "responded in detail to these concerns in its November, 2009 report, *NIOSH Evaluation of Data Adequacy and Completeness Issus at*	NIOSH concurs with the recommendation to close this matrix item.

			the Mound Laboratory (NIOSH 2009b), and again in its August 2011 report, *NIOSH Evaluation of Data Adequacy and Completeness Issues at the Mound Laboratory* (NIOSH 2011). During the June 5, 2012, Work Group meeting (ABRWH 2012, WG transcripts, p. 205), SC&A acknowledged NIOSH's responsiveness to two of the sub-issues regarding "~95% of data found for selected individuals was collected in 1990 and later…Pre-1990 results included uranium, thorium, and curium" and "Majority of pre-1990 results not available in MESH" and recommends that the Work Group close these sub-issues. For the other issues—recognizing that data comparison is rendered difficult due to units and radionuclides not always matching and that volume corrections were not possible in many cases—SC&A views these as enhancements, for clarity sake, that NIOSH can consider for future TBD revisions. Overall, SC&A recommends closure of this site profile item.	
6	5.4.3.	Matrix Issues #11, 12, and 13 Secondary/Other Radionuclide Data (MJW Evaluation)	SC&A agrees with NIOSH's 2011 conclusion (NIOSH 2011) that the scale of workers affected is relatively small, given the research context of this laboratory work, but continues to contend that NIOSH needs to reconcile these original MJW quality findings for "other" radionuclides with how it is approaching dose reconstruction for them in the Occupational Internal Dose TBD. Although the number of workers was small relative to tritium and plutonium production operations, research was a prime mission of Mound and needs to be addressed accordingly in terms of the adequacy of bioassay data being used in reconstructing doses for those workers. If they are not to be ignored in the dose reconstruction program for Mound, how are such doses being assigned?	Potential internal doses from these exposures are assigned on the basis of records supplied by DOE. The Mound internal TBD contains guidance, in section 5.9, for assigning doses from thorium (§ 5.9.2), ^{231}Pa (§ 5.9.3), uranium (§ 5.9.4), for the reactor fuels project, based on U, Pu, and Th (§ 5.9.5), the reactor waste project (§ 5.9.6), americium and curium (§ 5.9.7), and from the rare isotopes project, based on U and Pu progenitors in the process (§ 5.9.8). We report the bioassay methodology for those radionuclides for which we typically find bioassay data in claimant records. Dose reconstructors are required to reconstruct, or overestimate, doses for all internal dose monitoring results, and though the guidance in the TBD is intended to cover all likely

				situations, it is possible that additional data not corresponding to one of the methods in section 5.9 of the TBD will be discovered. In this case, the DR must reconstruct the dose in the most effective way possible outside guidance in the TBD, typically with the assistance of the Principal Internal Dosimetrist. As discussed at length during the working group sessions (e.g., transcript, January 6, 2010, starting at page 82, line 12), the King document is intended to list the potential presence of every possible radionuclide in every possible location, rather than to suggest, in each location, a presumptive intake.
7	5.4.4	Matrix Issues #11, 12, and 13 Tritium Logbooks Missing for 1976 and 1977	An SEC was added to account for missing tritium logbook data.	NIOSH concurs with the recommendation to close this matrix item.
8	5.4.5	Matrix Issues #11, 12, and 13 Tritium Bioassay Data Adequacy	Bounding method for STC addresses SC&A's original concern.	NIOSH concurs with the recommendation to close this matrix item.
9	5.4.6	Matrix Issues #11, 12, and 13 Plutonium Data Comparison	Regarding PURECON: *As recommended in Section 5.4.6 above, the Work Group should request that NIOSH provide a summary of how it conducted a validation of Mound's internal and external dose databases.*	NIOSH did not itself do a validation and verification of Mound's PURECON database. PURECON printouts are considered to be reference information and treated as one source of information to be used in individual dose reconstructions, evaluated along with scans of primary records and MESH records from employee files.

10	5.4.7	Matrix Issues #11, 12, and 13 Polonium Data Comparison	Regarding PORECON: *As recommended in Section 5.4.6 above, the Work Group should request that NIOSH provide a summary of how it conducted a validation of Mound's internal and external dose databases.*	NIOSH did not itself do a validation and verification of the Mound PORECON database. PORECON printouts are considered to be reference information and treated as one source of information to be used in individual dose reconstructions, evaluated along with scans of primary records and MESH records from employee files.
11	5.4.8	Matrix Issues #11, 12, and 13 Fecal Bioassay Data	In its 2009 report, Mound Internal Dosimetry Data Completeness, SC&A (2009a) found that there are relatively few fecal results in the plutonium urinalysis bioassay results database (PURECON) (i.e., total of 29 fecal samples for 12 individuals for the entire Mound worker population) and that there is poor overlap of data with corresponding logbooks for the same time periods. A majority of the data found in the logbooks were not found in the individual exposure files. As many of these samples were likely collected as a result of an incident or suspected plutonium exposure, the data can be critical to best-estimate dose reconstruction. When SC&A mentioned this data completeness concern during the June 5, 2012, Work Group meeting, NIOSH pointed out that it does not intend to make use of the fecal sampling records, rendering moot the incompleteness of these records (ABRWH 2012, WG transcripts, p. 214). SC&A recommends that the Work Group request confirmation from NIOSH that Mound fecal data have no use in dose reconstruction.	The Mound Internal Dose TBD contains provisions to use fecal data. However, as SC&A points out, Mound has fecal data only infrequently, and urinalysis data are plentiful in most worker records. The Mound dose reconstruction approach therefore relies primarily upon the urinalysis data. The Mound TBD requires dose reconstructors to evaluate fecal data using the IMBA program or other program resources in section 5.7.2, *Fecal Sample Data:* *Fecal samples were also infrequent during most of the history of the Mound site's internal dose monitoring program. When fecal data are present in claim records, they should be reconciled with urinalysis data in estimating the internal dose. Guidance for this is given in ORAUT-OTIB-0060 (ORAUT 2007a). MDAs for fecal data are listed in the table below. For dose reconstruction, resolution of fecal samples may be performed using the MDAs listed in Table 5-8 below. These MDAs were reported as part of a retrospective*

				project to establish MDAs for Mound bioassay procedures conducted in 1995 (Author unknown undated).
12	5.4.9	Matrix Issues #11, 12, and 13 Tritium (HTO) Data Comparison	Regarding Tritium (HTO): *As for the findings in Sections 5.4.6 and 5.4.7 above, SC&A recommends that the Work Group request that NIOSH provide a summary of how it conducted a validation of Mound's internal and external dose databases in this context.*	NIOSH has not conducted a validation and verification to ensure the MESH database is complete with respect to tritium results. In fact, the MESH database offers only summary data prior to 1981, and zero results listed for each year may be spurious. That is, a zero dose is documented in MESH, when monitoring may not have been performed. For dose reconstruction, in general, primary records are used, along with the MESH printouts (provided by DOE), for calculating tritium doses. While some claims have no primary records for tritium urinalysis in the "DOE Response" file, logbook pages have been linked as "Personnel Exposure" files, for at least some cases. For other cases, to which the records are not linked, the dose reconstructor is instructed to consult the logbooks, which are available in Mound electronic files. The technical basis addresses this contingency in Section 5.8.3, *Tritium* (second paragraph): *For 1957 onward, the listed and zero doses may be used, with equation 5-2, to assign a dose only when dose overestimates are appropriate. If they are not appropriate, it is necessary for the dose reconstructor to review tritium logbooks for the employee's name for the years in question and to assign dose from tritium bioassay, or missed dose based on these records instead.*

13	5.4.10	Matrix Issues #11, 12, and 13 Thorium Bioassay Data	In its 2009 report, *Mound Internal Dosimetry Data Adequacy*, SC&A (2009c) concluded the following: *In summary, the limited amount of data and the shortcomings associated with data interpretation remains for thorium beyond the established SEC period ending on February 29, 1959. Although urinalysis data exist for thorium prior to 1970, procedures on how these samples were analyzed and interpreted are not available. The data infers* [sic] *that at least a portion of the thorium analysis was analyzed by the radium extraction and differential counting method to measure the radium daughter of the thorium. If this is the case, then, as noted by MJW, there are a lot of questionable assumptions that need to be made is using an excreted daughter to estimate the intake of a parent…the lack of bioassay procedure information can make the derivation of the MDA or MDC, which forms the basis for NIOSH's proposed method of assigning missed doses, difficult.* An additional concern is the potential for Class YY insoluble thorium being handled at Mound. In 1996–1997… The Work Group subsequently closed all but the question of Class YY solubility, an issue that NIOSH (Jim Neton) believed had been addressed in terms of dose reconstruction methodology at other DOE sites being reviewed; this was to be confirmed and a consistent approach for handling highly insoluble thorium applied to Mound (ABRWH 2012, WG transcripts, p. 216). SC&A recommends that the Work Group confirm that NIOSH has addressed this question at other DOE sites and whether such an approach has been made available for Mound dose reconstructors.	Regarding the "Class YY" concern: SC&A released, in September 2012, its *SC&A REVIEW OF LAWRENCE BERKELY NATIONAL LABORATORY SITE PROFILE MATRIX ISSUE #3*. This document makes the statement that *SC&A agrees with the NIOSH response that solubility Type S, as provided by the Human Respiratory Model described in ICRP 66 (ICRP 1994), adequately bounds the behavior of "high-fired" uranium. The same applies to thorium compounds.* Though this document applies, strictly speaking, to Lawrence Berkeley Laboratory (LBNL), it is clear that the conclusion applies generally, rather than just to the compounds encountered at LBNL.

1. Carbaugh, E.H., D.E. Bihl, and J.A. MacLellan, "Methods and Models of the Hanford Internal Dosimetry Program," PNNL-MA-860, January 1, 2003.