Response to "A DRAFT REVIEW OF ORAUT-TKBS-0017-5, REVISION 03, FEED MATERIALS PRODUCTION CENTER – OCCUPATIONAL INTERNAL DOSE, (SCA-TR-2017-SP004)"

The following are responses to items which were identified in Table 3-1. SC&A Recommendations Summary of SCA-TR-2017-SP004.

Doc	No	Finding Text	SC&A Recommendation
TBD	**7**	**The TBD does not specify a method for estimating doses in the raffinate streams, which are uranium poor, from ore processing in Plant 2/3. These doses may be very difficult to calculate, especially for high-grade ores, notably pitchblende ore from Congo.**	**In progress**

Per ORAUT-TKBS-0017-5, Rev. 3, "The raffinate handling and transfer operation in Plant 2/3 was of a slurry form, and the raffinates were transferred in process lines directly to the silos. This operation was quite different from the drum handling described above. The bounding process is taken to be the opening of the drums in Plant 2… Therefore, uranium bioassay was adequate and the other components contributing to the dose can be assigned by using ratios to uranium."

NIOSH's position is that the raffinates remained in slurry form until disposition, either in waste silos for the pitchblende ores, or in waste pits in later years. Consequently, there was almost no potential for exposure to uranium-poor raffinates.

Doc	No	Finding Text	SC&A Recommendation
TBD	**8**	**Workers who may have worked with raffinates may be missed by the protocol specified in Volume 5 of the TBD. The guidelines for determining which workers were exposed to raffinate dusts are too restrictive and place far too great a reliance on completeness of records for job assignments, or in the alternative, place the burden of proof on the claimant. They have not been adequately justified by measurements and are not claimant favorable.**	**In progress**

There is a statement in Volume 5 of the TBD that workers in Plants 1, 2, 3, and 8 might have been exposed to yellowcake, but that is not intended as a guide to dose reconstructors to select certain claims for yellowcake exposure. There is no way of knowing which workers were exposed to ores, concentrates, or raffinates. Workers often rotated to various buildings throughout their employment and the records do not provide complete history of work locations. It is not the intent to restrict the raffinate dose assignment to those buildings where exposure occurred. Therefore, the standard practice is to assume that all workers in the relevant time periods have ore, concentrate, or raffinate exposure potential and are assigned intakes accordingly, unless there is a reason they should be excluded (e.g. secretary or administrative personnel who worked only in in non-radiological area).

Doc	No	Finding Text	SC&A Recommendation
TBD	**9**	**The data on trace contaminants in RU in the Fernald TBD are incomplete and appear to be incorrect. Different official documents have very different values for various aspects of RU data, including production and contamination. The contradictions have not been sorted out in the TBD.**	**In progress**

NIOSH reviewed the information provided in SRDB Reference ID# 3644, DOE Ohio Field Office Recycled Uranium Project Report 1941-1999 to determine if there was a real potential for recycled uranium contaminants to exceed 10 ppb plutonium. Based on our analysis of the recycled uranium contaminant levels by material type provided in the Ohio Field Office report, NIOSH sees no indication of routine exposure of recycled uranium contaminants greater than 10 ppb plutonium prior to 1973. NIOSH does recognize that there are rare individual lots that may result in short term exposure slightly above the suggested recycled uranium contaminant levels. However, these are small quantities for very short durations (lots are reported on a monthly basis). Therefore, the vast majority (probably greater than 95%) of the lots, prior to 1973, are much less than 1 ppb plutonium.

The recommendation in Rev 0 of ORAUT-RPRT-0052, "Feed Materials Production Center Internal Dose Topics," (7/12/2011) of the use of 100 ppb plutonium was based on the assumption that it would be easier not to change the method that was recommended at the time for dose reconstructions prior to 1973. Therefore, the use of 100 ppb plutonium would continue to be used for simplicity and conservatism purposes. However, during the update to the TBD, the recycled uranium contaminants were required to be recalculated to address Am-241.

Since a complete rework was needed, NIOSH determined that a more realistic bounding scenario should be implemented based on the information in the Ohio Field Office report. In this report, the Ohio Field Office addressed issues such as top cropping and concluded that processes like this could result in an increase in the recycled uranium contaminants. However, the data for the material type identified as top cropping, prior to 1973, did not exceed 10 ppb plutonium. Therefore, NIOSH concluded that the 100 ppb plutonium was an unrealistic conservatism and reverted to the 10 ppb plutonium. The only material types that resulted in higher than 10 ppb plutonium, such as the tower ash and MgF2, had Lots dates after 1972 and therefore would be covered in the higher ratio used in the post-1972 period.

Doc	No	Finding Text	SC&A Recommendation
TBD	**11**	**The suggested approach for RU dose estimation in the TBD is claimant favorable for many RU workers, but not claimant favorable for others and for some periods; it is not based on an evaluation of the available data.**	**In progress**

See response for TBD 9 above.

Doc	No	Finding Text	SC&A Recommendation
SEC P	**3**	**Default concentrations (on U mass basis) of Pu-239, Np-237, and other isotopes associated with RU at Fernald may not be bounding for some classes of worker activities, buildings, and time periods.**	**In progress**

See response for TBD 9 above.

The values for contaminants in RU have been selected to bound the overall ratio for any employee in any given year. Until at least the 1980's Fernald employees were essentially chronically exposed to uranium throughout the year. Consequently, in a given year an employee was exposed to multiple batches of different material types. While some batches of some material types have contaminant concentrations higher than those in the TBD, the TBD values are considered to bound the average contaminant concentration that an employee would experience.

Fernald frequently reported values of plutonium in RU in unis of ppb, although they determined plutonium content through radiological analysis. They then used Pu-239 specific activity to convert the radiologically-determined plutonium content to ppb. Using a Pu-239 specific activity of 139.6 dpm per ng (or 139.6 plutonium dpm per g of RU), 400 ppb translates to 55,840 dpm plutonium per g of RU. That activity is then apportioned among the various alpha-emitting plutonium isotopes and americium in the relative abundance that is anticipated for 30-year aged weapons-grade plutonium. That age was selected because the exposures at Fernald could have occurred 30 years after the initial production of the plutonium, and the americium contribution to doses is higher at 30-years post-production than earlier.

A spreadsheet that illustrates the RU contaminant calculations is provided separately.

Doc	No	Finding Text	SC&A Recommendation
SCA 2014d	**2**	**Given that the monitoring program does not appear to be directly focused on areas where thorium exposure potential existed, coupled with the inability to effectively identify which workers may have handled thorium materials, NIOSH should instruct the dose reconstructors to assign the 95th percentile coworker intake value to all unmonitored claimants who may have been directly involved in thorium operations.**	**In progress**

The instructions for using the 50th percentile value for most workers is in section 5.5.2.3.1 "Thorium Co-worker Model, 1979-1989. For most of this time, the only activity involving thorium was the occasional repackaging of deteriorated drums. Those repackaging efforts were of extremely limited duration. Consequently for most of this period there were no workers with significant thorium exposure potential. Applying the 50th percentile coworker dose to all workers easily bounds exposures for all workers for the majority of the 1979-1989 period.

In 1988 and 1989 some of the earliest thorium remediation activities began. Workers on the earliest projects were required to have in vivo monitoring (thus in this era the in vivo monitoring program was specified for the most highly exposed thorium workers), and for some projects baseline fecal samples were collected. Thus the use of baseline fecal samples as an identifier for the most highly exposed population (in the event any of those claims lack in vivo data) is an appropriate choice. The majority, if not all, thorium workers from the 1988-1989 period should have in vivo data.