K-25 SITE, OAK RIDGE GASEOUS DIFFUSION PLANT ISSUES MATRIX

October 2012 Update – New or edited information appears in red text

No.	TBD	Issue	SC&A Draft Finding	NIOSH Response
1	0009-5 (Occupational Internal Dose) ***CLOSED***	More guidance needed on appropriate enrichment assumptions.	More guidance is needed regarding appropriate enrichment to assume when interpreting uranium bioassay mass concentration data; the enrichment assumed for default isotopic distribution may not be appropriate.	Up to 1993, bioassay records for K-25 employees list results for uranium as mass measurements (normally in milligrams per liter) and gross alpha results (dpm/100 milliliters). Thereafter, isotopic uranium results are available. Gross alpha or isotopic uranium would typically be used for a dose reconstruction. Gross alpha measurements are favorable to the claimant since the results are more sensitive; the activity is known; and assumptions about enrichment are not necessary. However, if uranium mass bioassay is used and converted to total uranium alpha, the derived uranium results must be consistent with the gross alpha (or isotopic) bioassay. Table 5-1 will be revised to include 3% enrichment as the default value. In addition, total uranium activity and gross alpha activity are assessed as uranium-234 as a claimant-favorable measure. This information will be clarified and incorporated into the next revision of the K-25 Occupational Internal Dose TBD.
SC&A Response: **Agree** with the NIOSH response, with one question: Would there be circumstances where the 3% enrichment default would not be appropriate given inclusion of reprocessed fuel in feed material? How would that issue be addressed? **July 2011 Update:** At the July 6, 2011, Work Group meeting, NIOSH confirmed that enrichment levels have no bearing on dose reconstruction, given reliance on gross alpha measurements, and that the 3% enrichment default value and U-234 as an assumed basis for claimant-favorable assessment would be added in the next TBD revision. Based on this discussion, the Work Group **closed** this issue.				
2	0009-5 ***CLOSED***	No default absorption (solubility) classes for intakes.	Absorption classes listed for UO_3 and U_3O_8 appear to be incorrect. No discussion for high-fired uranium oxides.	The compound of the material is not considered during the dose reconstruction process. Since there can be several related variables when reconstructing the internal dose, lung absorption types F, M, and S are evaluated for uranium and the most claimant-favorable type is assigned. Therefore, Table 5-3 will be deleted from the K-25 Occupational Internal Dose TBD since it provides no added value. In addition, the TBD will be updated to clarify the evaluation of the lung absorption types for claimant favorability.
SC&A Response: **Further clarification needed**. How are high-fired uranium oxides ("class Y" or "super S") addressed? These compounds would exhibit different biokinetic behavior when taken up in the body. **July 2011 Update:** NIOSH indicated that there has been no evidence to date of any high-fired, insoluble uranium oxides at K-25, but would be vigilant on the issue. Based on this discussion, the Work Group **closed** this issue.				

3	0009-5 ***IN ABEYANCE***	Default isotopic distribution not claimant favorable.	It does not contain Pu-238, Pu-240, Pu-241, and Pu-242; Cm-242 and Cm-244; and it assumes only low enriched (2%) uranium; and the Tc-99 ratio is questionably low.	The default isotopic distribution listed in Table 5-6 as Pu-239 represents total plutonium (all plutonium isotopes). This information is stated in Table 5-4, footnote b. A footnote with this information will be added to Table 5-6 upon revision of the K-25 Internal Dose TBD. Radionuclides Cm-242 and Cm-244 will be deleted from Table 5-2 since these radionuclides may have been present only in trace quantities. The actual enrichment of uranium at the K-25 Plant varied throughout the years. Through 1964, K-25 was capable of enriching uranium up to 93% U-235 (SRDB 16497). After the shutdown of the HEU facilities in 1964 approximately 2 to 5% U-235 was produced (SRDB 16497). As stated in the response to Item #1, NIOSH agrees the default enrichment should be 3% and will revise the K-25 Internal Dose TBD accordingly. After review of SRDB 16497, and in comparison to the default value listed for Paducah, NIOSH agrees the Tc-99 default value listed in Table 5-6 requires further evaluation. Values in Table 5-6 will be corrected in the next revision of the K-25 Internal TBD.
SC&A Response: Further clarification needed. If Cm-242 and Cm-244 are to be deleted from DR consideration, some confirmatory basis should be provided. **July 2011 Update:** NIOSH indicated that while there is no evidence of Cm at K-25, there is a need to revisit Table 5-6 as part of the recycled uranium assessment to address its accuracy and completeness. Based on this discussion, the Work Group is holding this issue **in abeyance** awaiting NIOSH's proposed changes. Updated DCAS Response: In order to ensure that claimant-favorable activity fractions for recycled uranium contaminants are applied, the highest (except where noted) isotopic concentration values recorded in Table 2.4-1 of the Recycled Uranium Mass Balance Project Oak Ridge Gaseous Diffusion Plant (ref ID 016497) was adopted. The values are based on work activities, locations, and time frames posing the greatest potential for workers to be exposed to recycled uranium. The recorded concentrations come from activities performed during oxide conversion, cascade building operations, uranium recovery operations, and analytical laboratory analysis. In addition, the concentrations include potential worker exposure during the CIP/CUP campaigns. The activity fractions for RU exceed those currently listed in Table 5-6 of the K-25 Internal TBD; therefore, the assignment of RU contaminants are being revised and incorporated into the DRAFT K-25 Internal TBD.				
4	0009-5 ***IN ABEYANCE***	TBD inconsistent or lacks complete information on radionuclides.	General lack of consistency and lack of complete radionuclide guidance and information for facilities in tables provided. Several major radionuclides not shown in source terms for various buildings in Table 5-4.	The information in Table 5-4 of the K-25 Internal Dose TBD was obtained from Reference ID 16497. The radionuclides listed in Table 5-4 are the RU constituents of most concern for each location. Table 5-2, lists all the radionuclides encountered at K-25. However, as previously stated in Response #3, Cm-242 and Cm-244 will be removed from Table 5-2 upon revision to the K-25 Internal Dose TBD. A footnote

				will be added to Table 5-4 to better clarify this information.
SC&A Response: <u>Disagree</u>. SC&A's comments point out a number of information sources that suggest that ID 16497 may not be complete and that the TBD does not account for all buildings that may have contained radiological hazards. NIOSH should corroborate its source term citations and building listings beyond ID 16497. **July 2011 Update:** NIOSH agreed that the indicated tables will be corrected. Based on this response, the Work Group is holding this issue **<u>in abeyance</u>.** <u>Updated DCAS response</u>: Table 5-4 will be removed from the Internal TBD since the information is not used in the dose reconstruction process. The radionuclides of concern at K-25 will be reported in the revised TBD. The Oak Ridge Gaseous Diffusion Plant consisted of over 400 buildings; it is therefore not feasible to include all of them in the TBD. However, a table listing the buildings and support facilities involved in uranium operations will be included in the revised TBD. A more comprehensive list of buildings, time frame of operations, and activities was added to the DRAFT K-25 Site Description. Additional references were citied regarding the source term and facilities at the K-25 Plant.				
5	0009-5 ***<u>IN ABEYANCE</u>***	Lack of information regarding incidents.	Lack of incident information for those with significant intakes could hinder accurate interpretation of bioassay results and identification of intakes of unmonitored or inadequately monitored workers.	Because dose is always assigned when there are bioassay results, detailed incident information can be helpful but in most cases is not necessary. Many cases are completed using over- or underestimates, where maximizing or minimizing assumptions are made. In the small fraction of cases needing best estimates, reasonable but claimant-favorable assumptions are made when there is a lack of information, such as intake date. In such cases, it is more likely that the additional information would result in a smaller dose estimate. For example, urine samples are typically collected within a few days of a known incident. If there is no incident identified in the file, the default date would be at the midpoint since the previous sample, which would yield a larger intake. If necessary, a supplemental request to the site for additional information regarding the incident in question can be made.
SC&A Response: <u>Agree</u> that incident data are helpful in some cases, but not necessarily in most cases; but disagree with the implication that NIOSH should not seek to locate whatever incident data exist (apparently an incident notification system did exist) for the sake of cases that would benefit. **July 2011 Update:** NIOSH indicated that it would try to identify a more complete set of incidents, but could not predict what additional information would be available. The Work Group will hold this issue **<u>in abeyance</u>** awaiting NIOSH's actions to resolve this issue. <u>Updated DCAS Response</u>: Dates, buildings, and description of significant incidents with internal dose potential will be discussed in the revised K-25 Site Description and Occupational Internal Dose TBDs.				
6	0009-5 ***<u>IN</u>***	Coworker data use and approach for unmonitored employees may not be	**a. Use of median bioassay data values from 1948 to 1988 for uranium intake rates and 1978 to 1988 data for Tc-99 intake rates may not be reasonable or claimant**	NIOSH agrees that there is variation in the intake rates; that is why the median value of a lognormal distribution is assigned along with the geometric standard deviation. The dose reconstructor can assign the 84th percentile when it appears warranted for a specific case, but the routine assignment of the 84th percentile to all unmonitored individuals

	ABEYANCE	appropriate.	**favorable.** NIOSH needs to determine if work processes, exposure conditions, and radiological controls for 1945-1947 were similar to periods that followed to permit use of earlier intake rates. Also, SC&A found the guidance for dose reconstructors to be vague, advising that the "maximum ***reasonable*** coworker dose" be applied [emphasis added], without defining what is meant by "reasonable." **b. Not clear whether assumed acute intakes would be more claimant favorable than stipulated chronic intakes.** While NIOSH default assumption is to assume chronic intakes, stronger basis should be provided for why that is necessarily more claimant favorable given K-25 exposure history of incidents and variable uranium releases. **c. To what extent higher solubility uranium compounds (e.g., Type F) would not have been detectable once a bioassay program was established in 1948.** NIOSH is using intakes modeled from 1948-1988 to estimate intakes of workers prior to 1948; however, if any workers had relatively large intakes of Type F uranium in 1945-1946, it is possible bioassays in 1948 would not have detected them. **d. Whether use of the outdated ICRP 23 vs. 89 volume parameters would bias DR calculations in a claimant-unfavorable manner.** Urine bioassay	is not reasonable because it assumes that all unmonitored workers were routinely exposed to larger concentrations than monitored workers. ORAUT-OTIB-0060, Internal Dose Reconstruction, provides information for unmonitored workers and the assignment of coworker dose. This TIB will be added to the Reference section of the K-25 Internal Dose TBD upon revision.

			data was normalized to 1,400 ml, which is from ICRP 23, currently an outdated reference updated with ICRP 89 that uses 1,600 ml for 24-hr excretion volume, a 10% difference.	

SC&A Response: **Disagree** with NIOSH response in that it is unresponsive to key SC&A review issues including whether earlier operations and radiological controls can be normalized over such a large time period, to what extent higher solubility uranium compounds (e.g., Type F) would not have been detectable once a bioassay program was established, to what extent multiple acute vs. chronic exposures would be more bounding, and whether use of the outdated ICRP 23 vs. 89 volume parameters would bias DR calculations in a claimant-unfavorable manner.

July 2011 Update: NIOSH pointed out that it actually applies the median and 95th percentile for coworker dose assignment; the 84th percentile distribution is only used to derive the GSD. SC&A pointed out while it accepts that response, there were other sub-issues imbedded in the SC&A profile review finding (which were highlighted in its response). Following some discussion of the sub-issues, SC&A agreed to highlight them in a revised finding description in this matrix for NIOSH reconsideration. The Work Group thereby has held this issue **in abeyance** to permit NIOSH an opportunity to review them.

SC&A Response (October 2012): SC&A highlights description of "sub-issues" identified in its site profile review finding, which were discussed at the July 6, 2011 WG meeting.

Updated DCAS response for sub issues a - c above:

Parts A&C) ***Regarding whether the 1948-1988 intake rates can be applied for 1945-1947:***

As described in ORAUT-OTIB-0035, urinalysis results were fit into IMBA using types F, M, S materials to derive intake rates for 1948-1988. The results of the IMBA fitted data are graphically presented in B-1 through B-6 of ORAUT-OTIB-0035. Those figures contain the curves of the predicted urine concentration from the derived intake rate in comparison to the actual bioassay results. It was determined that the use of a single chronic (continuous) intake was appropriate since the uranium excretion rates were relatively constant from 1948-1988. The solid lines in Figures B-1 to B-6 show the individual fits to the 50th- and 84th-percentile excretion rates. Although the fitting routines for the intakes involve the effects of the biokinetics of the lung solubility type of the inhaled particulates at various times post-intake, the data indicates that the spread of the derived intake rates are directly proportional to the urine concentration data for all three solubility types.

However, to ensure claimant favorability for the time period of 1945-1947, the coworker intake rate tables are being expanded to allow the assignment of the 95th percentile uranium intake rates as a constant distribution. Verbiage is being added so dose reconstructors would assign the 95th percentile coworker intake rate for employees who have no monitoring data, were in an unknown work environment, and could have been routinely exposed to airborne radioactivity hazards.

Part B) ***Regarding whether assumed acute intakes would be more claimant favorable than stipulated chronic intakes*****:**

OTIB-0035 assigns a single continuous intake due to the relatively consistent urine results over the years. While the assumption of constant chronic intakes is considered to well describe the exposure conditions at K-25, it is also an acceptable method to assess exposure to multiple acute intakes when the time of the intake is not known.

This is part of the technical justification for using a chronic intake model to assign dose and missed dose from a urine bioassay result. All DCAS coworker models are developed and applied under the assumption that an unmonitored worker receives constant chronic intakes. As a result, this issue is global for all coworker models. Therefore, concerns with this methodology are to be dealt with outside the Gaseous Diffusion Plant Working Group. **Part D)** ***Regarding use of ICRP 23 versus ICRP 89:*** The use of ICRP 23 versus ICRP 89 is a global issue to be dealt with outside the Gaseous Diffusion Plant Working Group.				
7, 9, and 11	0009-6 (Occupational External Dose) ***IN ABEYANCE***	Uranium cylinder storage yard dose may be underestimated. Chronic neutron exposure opportunities may have been overlooked for early years. Reliance on single neutron-to-photon ratio for entire plant questionable.	Dose reconstructors instructed to add missed neutron dose only for workers in the cylinder yards, although their dosimeters were insensitive to any dose rate due to neutrons below the NTA cutoff (somewhere between 0.5 and 1.0 MeV). Little attention was apparently paid to the possibility of neutron exposure in the early years. It would be prudent to revisit whether some categories of workers may have been exposed to chronic low-level neutron exposure. K-25 plant had number of potential sources of neutron exposure that will have varied over time as processes, facilities, procedures, impurities, and enrichments changed.	The probable hazard from preparation and storage of UF_6 at K-25 was identified in 1943 (SRDB 8328). SRDB 21791 describes many elements of the routine ORGDP radiation safety program to detect, measure, and control worker radiation exposure to include the use of personnel neutron dosimeters. SRDB 29760 describes an evaluation of potential external radiological exposure from K-25 Plant UF_6 Cylinder Storage Yards to members of the public and other unmonitored individuals. The exposure scenario with the highest dose involved unmonitored site workers because these individuals could access the radiological posted areas present inside the site fencing. The estimated dose in this study was 125 mrem/yr based on a worker spending 250 hrs in a year (one hr per work day) in an area with measured dose equivalent rates that exceeded the 0.4 mrem/hr used to establish the boundary of the radiological area posting. The dose equivalent rate of 0.4 mrem/hr includes exposure to both gamma and neutrons using a conservative 4:1 gamma to neutron (i.e., neutron to gamma dose ratio = 0.25) dose ratio. Personnel dosimetry methods were very similar among the respective DOE Oak Ridge office gaseous diffusion plants (SRDB 79353). Dose reconstructors evaluate the energy employees' potential neutron exposure by reviewing the employees' job title, work location(s), and time period. If applicable, neutron dose is assigned using the neutron-to-photon ratio, as noted in the K-25 External Dose TBD Section 6.5.3.

				********** ORGDP did have capabilities to detect and measure significant neutron exposures as described in the respective "Standard Reference Information" provided by the Union Carbide and Carbon Corporation, (SRDB 21791). See for example Standard References SP-150, SP-152, SP-160, and SP-161. However, for reasons described in the DOE "Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities" (SRDB 4617) and in the NIOSH Health Hazard Evaluation Report (SRDB 10913), neutron exposures were considered to be insignificant in comparison with DOE radiation protection standard and also in comparison with beta/gamma exposure and potential intakes. As well, consider the response to #7 above, particularly with respect to dose reconstruction practices that evaluate the energy employees' potential neutron exposure by reviewing the employees' job title, work location(s), and time period. If applicable, neutron dose is assigned based on using the neutron-to-photon ratio, the calculated missed neutron dose, or an assigned unmonitored neutron dose based on employment. ********** Limited information has been received with respect to measured neutron and photon dose rates in the respective DOE Oak Ridge Office Gaseous Diffusion Plants because of the lack of personnel monitoring for neutron exposures, which were anticipated to be comparatively low. There are three studies of measured dose that were looked at. One study concerned calculation of the neutron-to-photon ratio based on the UF_6 cylinder painting project (SRDB 13682) performed at the Paducah Plant. The second study, SRDB 8122, was a neutron study performed at Portsmouth. The results from these two studies can be reasonably applied to K-25 because of their operational similarities and common dosimetry programs. The studies determined that a 0.2 neutron to gamma ratio was conservative and is prudent for the worst case areas which are the cylinder storage yards. A third study (SRDB 29760) describes an evaluation of potential external radiological exposure from K-25 Plant UF_6 Cylinder Storage Yards to members of the public and other unmonitored individuals. The exposure scenario with the highest

				dose involved unmonitored site workers because these individuals could access the radiological posted areas present inside the site fencing. The estimated dose in this study was 125 mrem/yr based on a worker spending 250 hrs in a year (one hr per work day) in an area with a measured dose equivalent rate that exceeded the 0.4 mrem/hr used to establish the boundary of the radiological area posting. The dose equivalent rate of 0.4 mrem/hr includes exposure to both gamma and neutrons using a conservative 4:1 gamma to neutron (i.e., neutron to gamma dose ratio = 0.25) dose ratio. According to the survey (SRDB 93592), performed at the K1066E cylinder storage yard, of the 86 sampling points only 9 locations resulted in detectable neutron levels. The gamma to neutron ratio was calculated based on only a total of 9 gamma and 9 neutron measurements. Since the data are limited and the actual n:p ratio would be lower than the TBDs value of 5:1 if all 86 sampling points were used, NIOSH feels that the 5:1 ratio currently documented in the K-25 TBD is favorable to the claimant.

The Work Group asked that SC&A issues 7 and 9 be combined:

SC&A Response (Issue 7): **Further clarification needed**. Will NIOSH revise the TBD to reflect the estimates contained in SRDB 27960, both for external exposure for unmonitored workers and the neutron component? (as opposed to the 75 mrem estimate now included?).

SC&A Response (Issue 9): **Agree** that neutron doses were a relatively small component of overall dose at the GDPs, but question whether it would be feasible for NIOSH to assign neutron dose (based on a neutron-to-photon ratio) without establishing what operations had a potential for lower-energy neutron exposure and what workers would have been involved.

SC&A Response (Issue 11): **Agree** that based on the available neutron surveys cited, the 5:1 photon/neutron ration appears bounding. However, these studies all focused on cylinder yards, so SC&A's concern that different operations and time periods where neutron doses may have been elevated and ratios may have been different (e.g., due to shielding) is not satisfied. However, SC&A acknowledges that this question may not be answerable without additional documentation regarding historic neutron exposures at K-25.

July 2011 Update: In response to all three SC&A neutron issues at the July 6, 2011, Work Group meeting, NIOSH indicated that it had found inconsistencies in how neutron exposure were addressed across the three GDPs and were in the process of re-evaluating its current approach for K-25. The Work Group will hold this issue **in abeyance** until NIOSH provides its revised approach.

Updated DCAS response: Since employees may have been exposed to neutrons while working in certain facilities or areas of the plant, instructions for the assignment of unmonitored and/or missed neutron doses will be added to the External Technical Basis Document (TBD). This will be accomplished by assigning neutron-to-photon ratios. The N:P ratios will be determined from the data obtained from the GDPs (SRDB 13682, 8122, 108666). In addition, a report, ORAUT-RPRT-0060, "*Neutron Dose from Highly Enriched Uranium,*" has been DRAFTED and is currently in internal review. This report is anticipated to provide support for a separate neutron-to-photon ratio for workers who may have been routinely exposed to highly enriched uranium. Once this evaluation process is completed, instructions will be provided to

dose reconstructors in the External TBD				
8	0009-6 ***CLOSED***	Until 1980, some dosimeters only processed upon request.	Until 1980, the TBD states that dosimeters were only processed upon request; another TBD statement points out that ORNL provided K-25 dosimeter and processing technical support starting in 1945. Unclear from these two statements whether dosimeters were routinely processed for workers or only done in some random frequency.	Beginning in 1945, through October, 1951, only the workers entering controlled radiation areas and those likely to receive a measurable dose, were assigned a dosimeter. Supervisors requested film badges and/or film rings for those employees working in areas where radiation exposure was likely (SRDB 16497, SRDB 21791, SRDB 13787). Supervisors made this decision with the support of the Health Physics, Medical, and Industrial Hygiene staff, daily readings from portable radiation detection instrumentation, pocket chambers, daily hand monitoring of employees, and spot checks to determine the extent of on-the-job contamination. The assigned dosimeters were provided by the Oak Ridge National Laboratory (ORNL) and the film badges were also processed by ORNL on a bi-weekly basis (SRDB 16497). In November 1951, through 1979, dosimeters were issued to the entire work force as part of their security/dosimetry badge. Again, only those likely to receive a measurable dose were processed. The dosimeters and the processing were provided by ORNL through 1979. Starting in 1980 (SRDB 20126), all issued dosimeters were processed regardless of the area the employee worked in or job activities. For dose reconstruction purposes, if an unmonitored worker had radiological exposure potential based on their occupation and/or potential work locations, then coworker doses are evaluated and assigned as necessary. Upon revision to the K-25 External Dose Technical Basis Document, a more detailed description of the assignment and processing of the dosimeters shall be added to better clarify site practices.
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011, meeting.				
10/12	0009-7/8 ***IN ABEYANCE***	Potential exposures to Tc-99 betas not recorded. All beta dosimetry based on uranium slab calibration.	Potential exposure to beta fields needs to be more fully evaluated; likely that film badges used in the 1945-1979 period could not detect Tc-99 (albeit details regarding dosimeter wrapping and cover materials would help judge this). Given that some workers were routinely exposed to Tc-99, and given dosimeters could have partly or completely missed	Neither film nor TLDs will likely detect the low energy beta from Tc-99. As discussed on pages 13 and 17 of TKBS-0009-6, Tc-99 poses minimal external exposure potential because of limited range and the shielding afforded by clothing and gloves. Energy employee exposure situations that potentially involved Tc-99 skin contamination would be addressed using VARSKIN to assist with the skin dose estimation. ********* SRDB 3902 and 30642 estimated radiation doses received by workers in

			lower energy beta fields, evaluation needed to determine degree to which Tc-99 was under-reported or missed entirely.	the feed plant from transuranics (TRU) and fission products (FPs) during the processing of uranium recycle materials handled during the period of 1953 through 1973. TRU and FP nuclides, including 99Tc, were processed in addition to uranium. Recorded doses for operators and maintenance mechanics at the Paducah Feed Plant were examined. External exposure from these nuclides contributed a small fraction in comparison with exposure from normal processing of uranium. The DOE "Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities" (SRDB 4617), states the low energy beta radiation from 99Tc is effectively attenuated by the protective clothing required for contamination control (e.g., one pair of industrial cloth coveralls, one pair of impermeable (Tyvek) coveralls and heavy neoprene gloves). As noted earlier, the primary hazard from 99Tc concerns skin contamination. Energy employee dose reconstructions that involve skin contamination, including Tc-99, are addressed if significant using VARSKIN.
The Work Group asked that SC&A issues 10 and 12 be combined: **SC&A Response (Issue 10):** **Disagree** that NIOSH has provided sufficient basis (discussion of quantities involved, contamination experience, doses reported, etc.) for its position that Tc-99 was of minimal dose significance outside of skin contamination, which would apparently be addressed on a case-by-case basis. The TBD should include more treatment of this exposure source. **SC&A Response (Issue 12):** **Disagree** that the Tc-99 source term contribution has been sufficiently characterized (per SC&A response to Issue 10 above). **July 2011 Update:** At the Work Group's July 6, 2011 meeting, NIOSH agreed that it would address Tc-99 skin contamination and external shallow dose potential for dose reconstruction into a white paper addressing all three GDPs, with emphasis on the chronic vs. incident nature of contamination, specific operations where contamination is likely, and significance of skin contamination. On this basis, the Work Group will hold these issues **in abeyance** awaiting completion of this NIOSH paper. **SC&A Response (October 2012):** NIOSH provided ORAUT-RPRT-0059, *External Exposure to Technetium-99 at the Gaseous Diffusion Plants*, dated Feb. 7, 2012. SC&A subsequently recommended closure of this issue for the Paducah Gaseous Diffusion Plant, and likewise, recommends **closure** of the issue for the K-25 TBD.				
SECONDARY ISSUES				
13s	0009-5 ***CLOSED***	There is a lack of guidance on bioassay interpretation.	The TBD needs to either provide more specific guidance to the dose reconstructor on several parameters that must be chosen or adjusted for intake and dose assessment, or reference the	Upon revision to the K-25 Internal TBD, and consistent with Response #1, clarification will be made to the bioassay data and/or appropriate references will be added. OTIB-0060 provides guidance on the general process of assessing intakes of radioactive material; the DRs are trained on this document.

			documents that will provide this guidance.	
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011 meeting.				
14s	0009-4 ***CLOSED***	There is no comparison between measured and predicted ambient radiation dose data.	A comparison between personnel dosimetry data (measured) with estimates based on ambient environmental exposures (predicted) would prove useful to validate the methods for reconstruction external environmental doses.	No comparison is made between environmental doses and personnel badge data because there are two different purposes for the data and their application is job dependent.
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011 meeting.				
15s	0009-5 ***CLOSED***	The TBD does not provide a consistent time period for the processing of RU at K-25.	The TBD should identify specific time periods that RU and its default isotopic distribution are to be assumed in intake assessment. This is not consistent with current guidance, and may not be claimant favorable.	Section 5.3 of the K-25 Internal TBD states the processing of recycled uranium began in 1952 at the K-25 Plant. The normal process during dose reconstruction is to include the RU contaminants beginning in 1952, through the energy employee's termination date. In the next revision to the TBD it will be clarified that RU contaminants will be assigned for all years at K-25 beginning in 1952.
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011 meeting.				
16s	0009-3 ***CLOSED***	The TBD fails to adequately define frequency and assess all types of X-rays in occupational medical exposure.	NIOSH should review its interpretation of included medical exposure, and should reasonably adopt a broader interpretation in the K-25 Occupational Medical TBD of occupational medical dose, as provided in the most recent version of ORAUT-OTIB-0006 (Kathren and Shockley 2005).	By regulation, only X-rays performed for screening can be included in occupational dose reconstruction (42 CFR 81). Screening would include X-rays performed for respirator certification, beryllium workers, asbestos workers, food handlers, termination exams, etc., in addition to radiographic screening of workers to monitor for disease. When x-ray records are requested from the site, it is assumed that all sources of records have been searched, including microfiche film. There is supporting evidence for K-25 that the film jacket for each worker contains all the X-rays ever received by the individual while employed at the K-25 Plant (SRDB 11105). Therefore, when actual X-ray records are provided by the DOE, the X-ray dose is assigned

				according to the frequency and type of examinations provided in the records. When no records are available, then the frequency listed in Table 3-1 of the K-25 Occupational Medical TBD is followed. ORAUT-OTIB-006, Revision 03 will be added to the reference section when the K-25 Occupational Medical TBD is next revised.
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011 meeting.				
17s	0009-3 ***CLOSED***	Techniques and protocols increase uncertainty of dose conversion factors (DCFs) listed in the TBD.	The Occupational Medical Dose TBD (Turner 2006) provides little documentation to support the assumed techniques and protocols applied to calculate the dose.	The K-25 Occupational Medical Dose TBD states that PA chest X-ray exams were performed beginning in 1944. From 1945 to 1956, 86% of these examinations were PFGs (SRDB 11105). Based on information received from the site X-ray technician, lateral chest exams were not conducted until the 1970s (SRDB 11105) which is consistent with radiology practice of that time. From a review of K-25 X-ray records, it is clear that lateral chest exams were not performed routinely for screening until the 1970s (SRDB 11105). Upon revision to the K-25 Occupational Medical TBD, a discussion of the substitute DCFs will be incorporated. In addition, a new revision to ORAUT-OTIB-0006 will be published in the next several months. This revision has a better description of the choice of substitute DCFs for poorly collimated beams and will be added to the reference section of the K-25 Occupational Medical TBD.
SC&A Response: **Agree** with NIOSH response. **July 2011 Update:** The Work Group **closed** this issue at its July 6, 2011 meeting.				