![SC&A logo] **Presentation Handout**
Carryover Items from February 2019 and 2021 SCPR Meetings
Meeting of the Subcommittee for Procedure Reviews
May 25, 2022

Table 1. Summary of documents with outstanding issues from February 2019 and February 2021 SCPR meetings

Document number [a]	Document title	Total findings [b]	Total obs. [b]	SCPR closed	In progress
DCAS-TIB-013	Selected Geometric Exposure Scenario Considerations for External Dose Reconstruction at Uranium Facilities	5	0	4	1
ORAUT-OTIB-0029	Internal Dosimetry Coworker Data for Y-12	5	0	4	1
ORAUT-OTIB-0044	Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Facility in Oak Ridge, Tennessee: Part 1 – Gamma Radiation	4	4	0	8
ORAUT-OTIB-0045	Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Plant in Oak Ridge, Tennessee: Part 2 – Neutron Radiation	2	3	0	5
ORAUT-OTIB-0046	Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Plant in Oak Ridge, Tennessee: Part 3 – Beta Radiation	3	5	0	8
ORAUT-OTIB-0064	Coworker External Dosimetry Data for the Y-12 National Security Complex	0	7	0	7
DCAS-PER-073	Birdsboro Steel and Foundry Company	1	7	0	8
No number assigned	Dose Reconstruction Methodology for the Peek Street Facility	8	2	0	10

[a] The Board Review System (BRS) was updated to include discussions from the February 2019 and February 2021 meetings of the Subcommittee for Procedure Reviews (SCPR) before access was lost due to the Cybersecurity Modernization Initiative.

[b] Finding and observation details follow this table.

Details of Findings and Observations from Table 1

DCAS-TIB-013: Selected Geometric Exposure Scenario Considerations for External Dose Reconstruction at Uranium Facilities

Finding 4: Technical information bulletin (TIB) underestimates maximum correction factor (CF) to be applied to badge readings.

Status

> **2/13/2019:** In progress – finding will be resolved with forthcoming issuance of ORAUT-OTIB-0089.

> **3/17/2022:** The Division of Compensation Analysis and Support (DCAS) does not have any new information to report. This TIB is being incorporated into DCAS-TIB-010 during International Commission on Radiological Protection (ICRP) Publication 116 implementation.

ORAUT-OTIB-0029: Internal Dosimetry Coworker Data for Y-12

Finding 4: The National Institute for Occupational Safety and Health (NIOSH) did not consider that urine samples were collected on a Monday morning, after a minimum of 48-hours absence from work area.

Status

> **Background:** In 2012, ORAUT-OTIB-0029 was cancelled and the technical information was incorporated into the Y-12 technical basis document (TBD) for occupational internal dose, ORAUT-TKBS-0014-5, revision 03. SC&A was tasked with reviewing ORAUT-TKBS-0014-5, revision 03, to assess whether finding 4 was adequately addressed. SC&A's review determined the NIOSH did not consider that routine urine samples were collected after a minimum of 48 hours of absence from the work area. In addition, NIOSH did not show that, for all time periods, 40 percent or more of the samples were not collected on Mondays.

> **2/18/2021:** In progress – NIOSH agreed to respond to SC&A's February 26, 2019, memorandum on Monday morning sampling.

> **3/17/2022:** DCAS does not have any new information to report. This OTIB has been cancelled, and a new Y-12 internal co-exposure model is scheduled to be developed using DCAS-IG-006. Once developed, the internal co-exposure models will be a new chapter 7 of the Y-12 site profile as ORAUT-TKBS-0014-7.

ORAUT-OTIB-0044: Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Facility in Oak Ridge, Tennessee: Part 1 – Gamma Radiation

SCPR meeting 10/31/2018: SC&A identified four findings and four observations.

Finding 1: The actual data distributions should be retained rather than replaced with predictions generated using data from a possibly nonrepresentative subset of 147 workers.

Finding 2: The validity of the model may not extend beyond the sampling period due to changes in the underlying processes. If the model does apply, the estimated prediction errors derived from within-sample data may not be appropriate outside of the sampling period.

Finding 3: It is highly unlikely that the uncertainty in predictions outside the sampling period should be as small as indicated by the precise estimates from the maximum likelihood regression model. The issue of out-of-sample validation is not resolved by using a large number of samples in the sampling period.

Finding 4: The scaling procedures should also address the worker's pre-1961 data where available. Additionally, it is not clear that historical records will be sufficient to document that the worker's exposure potential remained fairly constant over the time period required for workers with missed doses.

Observation 1: The units of millirem (mrem) need to be added to table 7-1, as appropriate.

Observation 2: The caption for table 7-1 should include the period 1947 to 1979, not 1947 to 1965 as it presently states.

Observation 3: The second line of the second paragraph states, "with the appropriate quarterly GM and GSD from Table 7-1 and applying an individual scaling factor φ." However, it appears that the geometric mean (GM) values are not used in tables 7-2 and 7-3. Should "GM" be replaced with "µ"?

Observation 4: The end of the second paragraph states, "Any calculated scaling factor that is less than one is changed to one so that the value of the expected quarterly dose can be increased but not decreased." Because the scaling factor (φ) appears in the exponent, shouldn't this sentence read: "Any calculated scaling factor that is less than zero is changed to zero so that the value of the expected quarterly dose can be increased but not decreased"?

Status

>   **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

>   **3/17/2022:** DCAS does not have any new information to report. The Y-12 external co-exposure model is currently being updated using DCAS-IG-006 and is approximately 80 percent complete. Once that is updated, this TIB will be cancelled.

ORAUT-OTIB-0045: Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Plant in Oak Ridge, Tennessee: Part 2 – Neutron Radiation

SCPR meeting 2/13/2019: SC&A presented its review and identified four findings and four observations.

Finding 1: The recommendation in OTIB-0045, page 16, to assume that 40 percent of the neutron dose equivalent falls below the 0.7 mega-electron volt (MeV) threshold of nuclear track emulsion, type A (NTA) film (correction factor of $1/(1.0 − 0.40) = 1.7$) does not agree with the

recommendation in ORAUT-OTIB-0051, revision 00, "Effect of Threshold Energy and Angular Response of NTA Film on Missed Neutron Dose at the Oak Ridge Y-12 Facility."

Finding 2: The recommendation in OTIB-0045, page 18, to assume that 40 percent of the neutron DE falls below the 0.7 MeV threshold of NTA film (correction factor of $1/(1.0 - 0.40) = 1.7$) does not agree with the recommendation in OTIB-0051.

Observation 1: The neutron-to-photon (n/p) GM values listed in OTIB-0045, table 7-1, are the same as the respective n/p GM values contained in the Q-Q plots in figures 6-2 through 6-5 and 6-7. However, the n/p geometric standard deviation (GSD) values in table 7-1 are all slightly higher than the respective values contained in the Q-Q plots.

Observation 2: It is not clear from the guidance in section 6.2 of OTIB-0045 if the minimum detection level value of 30 mrem was used when the gamma dose was reported as zero in all the analyses for all the departments, or just for the four departments mentioned.

Observation 3: OTIB-0045, section 8.0, should state the exact years the n/p values in table 7-1 are to be applied to provide for consistency in dose reconstruction (DR).

Status

> **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

> **3/17/2022:** DCAS does not have any new information to report. The Y-12 external co-exposure model is currently being updated using DCAS-IG-006 and is approximately 80% complete. Once updated, this TIB will be cancelled.

ORAUT-OTIB-0046: Historical Evaluation of the Film Badge Dosimetry Program at the Y-12 Plant in Oak Ridge, Tennessee: Part 3 – Beta Radiation

SCPR meeting 10/31/2018: SC&A presented its review and identified three findings and five observations.

Finding 1: Potentially important information in a reference cited in OTIB-0046 and the very critical information in table 4-1 of OTIB-0046 were not considered in OTIB-0046 or in the newer OTIB-0044 gamma document of 2013. This information may clearly show that work done during the late 1940s and early 1950s was not the same as work done in later years. If so, that indicates the n-worker regression models should not be used for extrapolating either gamma or beta doses.

Finding 2: Inspection of figures 1 and 2 in appendix A shows no such difference in the pattern of reduction in gamma and beta doses from 1956 through 1961. Therefore, the use of two different models for gamma and beta doses is not supported.

Finding 3: The estimated GM increases linearly going back in years from 1961 to 1947 but decreases in the years after 1961. Examination of the first formula on page 40 shows that the GM becomes negative when $(ti-1961) > 151.71/56.83 = 2.67$ years. Because the GM of a lognormal distribution must be a positive number, no predicted lognormal parameters can be estimated

using the linear dose model at any time after the fourth quarter of 1963. Note that the data used to estimate the model extend past 1963 to 1965, so the model cannot be used to make predictions in the final 2 years of the sampling period.

Observation 1: The text in section 7.3 refers to data being shown in boxplots. However, no specific figure numbers are provided. It would be helpful to have references to specific figures in the report.

Observation 2: Table 9-2 (which contains the key results of OTIB-0046) only provides prediction density parameters for the period 1947–1965. However, the "Purpose" section on page 8 states that the purpose of this document is to provide prediction densities for 1947 to 1979. Where are the data to be used for DR for the period 1966–1979?

Observation 3: The end of the first paragraph on page 43 states: "The adjustment is applied only if the calculated scaling factor is greater than 1, which will increase the value of the expected quarterly dose." Because the scaling factor (φ) appears in the exponent, should this sentence read: "The adjustment is applied only if the calculated scaling factor is greater than zero, which will increase the value of the expected quarterly dose"?

Observation 4: It appears that the units of mrem should be added to the dose of 2,361 near the end of the last sentence, just before the beginning of section 9.6.

Observation 5: The end of the first paragraph in section 9.6 on page 45 states: "If the scaling factor is less than unity (1), the scaling factor is set equal to 1 and the monitored population dose distributions are applied to that worker before 1961." Because the scaling factor (φ) appears in the exponent, should this sentence read: "If the scaling factor is less than zero, the scaling factor is set equal to zero and the monitored population dose distributions are applied to that worker before 1961"?

Status

>   **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

>   **3/17/2022:** DCAS does not have any new information to report. The Y-12 external co-exposure model is currently being updated using DCAS-IG-006 and is approximately 80 percent complete. Once that is updated, this TIB will be cancelled.

ORAUT-OTIB-0064: Coworker External Dosimetry Data for the Y-12 National Security Complex

SCPR meeting 10/31/2018: SC&A presented its review and identified seven observations.

Observation 1: The reference of "UCNC (1957)" maybe be incorrect. It appears that it should read "McLendon (1957)."

Observation 2: The reference of "UCNC (1957)" in the title for figure 6-1 maybe be incorrect. It appears that it should read "McLendon (1957)."

Observation 3: It is not obvious why table 7-1a only covers the period 1947–1951, instead of the complete period under review of 1947–1979. It may have been because of the change in the method of excluding or including the missed doses that occurred between 1951 and 1952, as outlined on pages 14 and 15 of OTIB-0064, although this is not stated in the text.

Observation 4: It is not obvious why table 7-1b and table 7-1c are separated between the years 1951 and 1952, when the most likely method would be to separate the two tables into two periods of 1947–1956 (when the regression model was used) and then 1957–1979, when the Y-12 coworker badge data from the Center for Epidemiologic Research (CER) were used. In addition, the statement on page 14, "The gamma and beta doses available from CER (see Section 6.0) were converted to annual data by summing the reported quarterly data for 1952 to 1979," adds to the confusion of the source of the data in tables 7-1b and 7-1c (i.e., were the 1952–1956 data derived from the regression model, or from the CER coworker data?).

Observation 5: It was indicated in step 2 that missed dose was not added to the resultant gamma doses from OTIB-0044 for the period 1947–1951 in table 7-1c, because missed dose had already been included. Does this also apply to OTIB-0046 beta doses for 1947–1951?

Observation 6: In step 5 it is stated, "Beta dose 95th-percentile values for 1947 to 1951 might need adjustment for dose reconstruction." However, there are no definite instructions to the dose reconstructor concerning the necessary steps to adjust these dose values to ensure consistence in DR.

Observation 7: The units of mrem need to be added to tables A-6 and A-7, and A-8, as appropriate.

Status

> **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

> **3/17/2022:** DCAS does not have any new information to report. The Y-12 external co-exposure model is currently being updated using DCAS-IG-006 and is approximately 80 percent complete. Once that is updated, this TIB will be cancelled. The external co-exposure models will be a new chapter 8 of the site profile as ORAUT-TKBS-0014-8.

DCAS-PER-073: Birdsboro Steel and Foundry Company

SCPR meeting 2/13/2021: SC&A presented its review and identified one finding and seven observations.

Finding 1: NIOSH neglected the external exposure to documented radiographic sources in assigning photon doses to Birdsboro workers.

Observation 1: SC&A suggests that NIOSH refer to the site as the "Birdsboro Steel Foundry and Machine Company."

Observation 2: The statement that TBD-6000 assumed that the standard workday was 8.8 hours is based on a misinterpretation. In fact, TBD-6000 assumed a 44-hour week, which was based on working 8 hours/day Monday–Friday and working half a day (4 hours) on Saturday.

Observation 3: SC&A recommends that NIOSH adopt April 19, 1951, as the date for processing the 346 lb of billets and April 19, 1951, for working on the five wafers.

Observation 4: The methodology used by NIOSH had the net effect of slightly overestimating the inhaled intakes of uranium.

Observation 5: NIOSH used an ingestion rate that is inconsistent with rates used in exposure assessments for other worksites that were based on OCAS-TIB-009 and is not claimant favorable. This is an overarching issue that applies to other sites and should be addressed in a wider context.

Observation 6: NIOSH erroneously cited the source of the ingestion rate of 1.1×10^{-4} m^2/h as NUREG/CR-5512, volume 1.

Observation 7: The beta dose rate to skin other than that of the hands and forearms in 1951 should be based on the long billet, as described by TBD-6000.

Status

> **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

> **3/17/2022:** Responses are being developed; however, DCAS will not be prepared to discuss Birdsboro at the May 2022 SCPR meeting.

Dose Reconstruction Methodology for the Peek Street Facility

SCPR meeting 2/13/2021: SC&A presented its review and identified eight findings and two observations.

Finding 1: The assumption of 100 percent 30–250 kiloelectron volts (keV) for the penetrating photon energy distribution is unsupported and inconsistent with assumptions used in the Hanford technical basis document.

Finding 2: The assumption of an uncertainty factor of 1.3 is unsupported and inconsistent with the cited reference.

Finding 3: SC&A was unable to verify the neutron-to-photon ratio of 1.2 using the cited references.

Finding 4: The dosimeter limit of detection used in the DR Template is not specified in the template, and the value of 0.050 rem assumed based on NIOSH's calculation is not consistent with the Hanford dosimeter information.

Finding 5: SC&A was unable to verify the Peek Street Facility (PSF) annual maximum ambient dose value using the cited reference.

Finding 6: The DR Template occupational medical dose basis contains incorrect information and outdated references.

Finding 7: The fission product information in the DR Template is not consistent with current guidance in ORAUT-OTIB-0054, revision 04.

Finding 8: No basis or reference is cited for the recycled uranium activity fractions in table 5 of the DR Template.

Observation 1: SC&A did not locate a PSF-specific tool containing the preprogrammed plutonium dose conversion factors.

Observation 2: The natural uranium PSL in the DR Template is not consistent with information in ORAUT 1997 and is not referenced.

Observation 3: The plutonium composition information is correct. However, the reference cited is outdated and needs updating.

Status

> **2/13/2019:** All findings and observations in progress – NIOSH needs to address findings and observations.

> **3/17/2022:** DCAS indicated that they should be prepared to discuss Peek Street DR Template findings and observations at the May 25, 2022, SCPR meeting.

References

McLendon, J. D. (1957, July 1). *Cumulative external radiation exposures* [Memorandum to J. S. Reece et al., Union Carbide Nuclear Company, Oak Ridge, Tennessee]. SRDB Ref. ID 23622

Oak Ridge Associated Universities Team (ORAUT). (1997). Excerpts from the KAPL radiological history report. SRDB Ref. ID 34947

Union Carbide Nuclear Company (UCNC). (1957, January 24). *December health physics report – Mechanics Operation Division, Y-B94-8 (excerpt)* [Letter to J. M. Case, Union Carbide Nuclear Company, Oak Ridge, Tennessee]. SRDB Ref. ID 23626