SC&A's Review of DCAS-PER-087, "Clarksville and Medina Modification Centers"

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Introduction

- The Clarksville Modification Center (CMC) was located in Clarksville, TN; covered period 1949-1967
- The Medina Modification Center (MMC) was located in San Antonio, TX; covered period 1958-1966
- The two sites were under contract to the U.S. Atomic Energy Commission to support nuclear weapons and weapon components maintenance and storage

Program evaluation report DCAS-PER-087

- Issued January 18, 2019, for the Clarksville and Medina Modification Centers
- Earlier revisions to ORAUT-TKBS-0039 primarily resulted in decreases (or no change) to dose estimates
- PER-087 (NIOSH, 2019) was issued because revision 03 of ORAUT-TKBS-0039 (NIOSH, 2017) could increase some external doses assigned

Potential areas of external dose increase

- Lumbar-spine (L-S) x-ray examination dose to some organs could increase because of the use of L-S exam doses as listed in ORAUT-OTIB-0006, revision 03 PC-1 (NIOSH, 2005)
- Dose to lower torso organs could increase for some workers due to establishing a scaling factor for workers who held weapon pits in their laps in the sitting position
- Unmonitored external shallow dose increased for all years due to the incorporation of ORAUT-OTIB-0086, revision 01 (NIOSH, 2016a), into the Pantex technical basis document (TBD), ORAUT-TKBS-0013-6 (NIOSH, 2016b)

Internal dose

- No changes in revision 03 of the TBD resulted in an increase in internal dose
- PER-087 does not contain internal dose modification recommendations

TBD for Clarksville and Medina Modification Centers

- Initial dose reconstructions (DRs) were based on using complex-wide methods or other documents
- ORAUT-TKBS-0039, revision 00 (NIOSH, 2006)
- ORAUT-TKBS-0039, revision 01 (NIOSH, 2012)
- ORAUT-TKBS-0039, revision 02 (NIOSH, 2013)
- ORAUT-TKBS-0039, revision 03 (NIOSH, 2017)

Cases to be evaluated under DCAS-PER-087

- Because of the variety of DR methods used in the past, no populations of claims were excluded from reevaluation based on their being unaffected by the latest changes
- All claims associated with the CMC and the MMC were considered

SC&A's review of PER-087 and TBD revision 03

- On March 15, 2021, the Advisory Board on Radiation and Worker Health tasked SC&A to review DCAS-PER-087 and the associated site profile, ORAUT-TKBS-0039, revision 03
- SC&A issued revision 1 of its review on September 28, 2021 (SC&A, 2021), addressing:
  - Subtask 1: Identify the circumstances that necessitated PER-087
  - Subtask 2: Assess NIOSH's specific methods for corrective action, including a review of ORAUT-TKBS-0039, revision 03
  - Subtask 3: Evaluate the PER's stated approach for identifying the number of DRs requiring reevaluation of dose
  - Subtask 4: Conduct audits of a sample set of reevaluated DRs mandated by PER-087

SC&A's review of PER-087 subtask 1

- **Subtask 1:** Identify the circumstances that necessitated PER-087
- SC&A's evaluation:
  - SC&A found that NIOSH correctly identified the changes in revision 03 of the TBD and addressed them in PER-087
  - SC&A had no observations or findings concerning subtask 1

SC&A's review of PER-087 subtask 2

- **Subtask 2:** Assess NIOSH's specific methods for corrective action, including a review of ORAUT-TKBS-0039, revision 03
- SC&A's review methodology:
  - Evaluation of status of findings from SC&A's review of TBD revision 00
  - Review of TBD revision 03 that necessitated PER-087

Previous SC&A evaluation of ORAUT-TKBS-0039, revision 00

- The Board tasked SC&A to conduct a technical review of revision 00 of ORAUT-TKBS-0039
- SC&A's (2012) review identified findings that could impact the reconstruction of worker doses
- SC&A identified seven findings concerning internal and external DR

SC&A's internal dose findings from review of TKBS-0039, revision 00

- SC&A had four findings about internal dose (findings 1, 2, 3, and 5)
- All internal dose findings were rendered moot by the designation of a Special Exposure Cohort (SEC) class for all employees at Clarksville and Medina for the operational years in question due to the inability to reconstruct internal doses

SC&A's external dose findings from review of TKBS-0039, revision 00

- **Finding 4:** Neutron-to-photon ratio method cited has been replaced with correction factor for neutron film coupled with Monte Carlo N-Particle (MCNP)-based estimate for missed doses below 0.5 MeV energy threshold; however, questions remain
- **Finding 6:** Use of surrogate Pantex external dose distribution for Clarksville/Medina "exposure groups" belies lack of dose records in earlier years, dosimeter uncertainty, and definitive operational information
- **Finding 7:** Lack of dose records and source term characterization data for Clarksville/Medina leads to use of inadequately justified surrogate data

Status of finding 4 from review of TKBS-0039, revision 00

- Finding 4: N/P ratio method cited has been replaced with correction factor for neutron film coupled with MCNP-based estimate for missed doses below 0.5 MeV energy threshold
- In subsequent NIOSH revisions of TKBS-0039, the MCNP approach was supplanted by use of correction factors with an overall correction factor of 2.9
- SC&A evaluated the individual correction factors and the resulting correction factor of 2.9 and is satisfied with this resolution; SC&A considers finding 4 resolved

Status of finding 6 from review of TKBS-0039, revision 00

- Finding 6: Use of surrogate Pantex external dose distribution for Clarksville/Medina
- NIOSH reworked all the previous claims per DCAS-PER-087, using revision 03 of the TBD and OTIB-0086; therefore, changes in external dose assignments were accounted for
- SC&A is satisfied with this resolution and considers finding 6 resolved

Status of finding 7 from review of TKBS-0039, revision 00

- Finding 7: Use of surrogate data for Clarksville is not adequately addressed in TBD
- SC&A did not find that finding 7 was adequately addressed in revision 03 of the TBD
- SC&A recommends that the original finding 7 remain open as finding 1 of this PER-087 review

Issues in TBD revision 03 that necessitated PER-087

- Three technical issues addressed in TBD revision 03 that resulted in the issuance of PER-087:
  1. Surrogate organ
  2. Pits in lap adjustment
  3. Shallow dose

SC&A's evaluation of TBD rev. 03 issues that resulted in PER-087

1. **Surrogate organ** – SC&A finds the surrogate organ changes in TBD revision 03 were correctly addressed in PER-087
2. **Pits in lap adjustment** – While SC&A concurs with the derivation of the scaling factor of 0.125, SC&A questions the application of it as stated on page 27 of TBD revision 03 (refer to observation 1 on slide 19)
3. **Shallow dose** – SC&A concurs that ORAUT-OTIB-0086, revision 01, should be used for assignment of shallow dose, per the Pantex external dose TBD

Observation 1

Observation 1: Scaling factor needs clarification

TBD revision 03, page 27, instructs the dose reconstructor to multiply the 95th-percentile glovebox correction factor ($2.19*(1.34)^{1.645}$) by 0.125; however, this equals 0.44, which would lower the actual dose assigned

It would appear that the wording in the first paragraph on page 27 of TBD revision 03 should instruct the dose reconstructor to use the following scaling factor:

$$\text{Scaling factor} = (1.0 \times 7/8 + 2.19*(1.34)^{1.645} \times 0.125) = 1.32$$

SC&A's review of PER-087 subtask 3

- **Subtask 3:** Evaluate the PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- NIOSH's search resulted in a total of 172 claims
- 122 claims were removed for various reasons:
  - 51 previous DRs resulted in a probability of causation (POC) >50 percent
  - 49 were included in the SEC
  - 11 were duplicate claims identified in the initial search
  - 11 were evaluated under a PER for Pantex
- 50 claims were recalculated using revision 03 of TKBS-0039 in conjunction with PER-087
- Rework of all 50 claims resulted in new POCs below 45 percent

SC&A's evaluation of NIOSH's claim selection process for subtask 3

- SC&A determined that the selection criteria used by NIOSH for previously completed DRs that require reevaluation under DCAS-PER-087 were valid
- SC&A had no findings or observations associated with subtask 3

SC&A's review of PER-087 subtask 4

- **Subtask 4:** Conduct audits of a sample set of reevaluated DRs mandated by PER-087
- SC&A recommended:
  - At least one DR be selected for review from each of the CMC and MMC sites during the respectively covered periods
  - Each of the DRs needs to include the requirement of assigning:
    - L-S x-ray examination dose
    - Lower torso dose due to handing weapons pits in the lap
    - External shallow dose
  - If all these exposures cannot be located in a single DR for each site, then additional DRs that do contain these elements will be needed
- Currently, SC&A has no findings or observation concerning subtask 4

Summary

- Finding 1: The use of surrogate data for Clarksville was not adequately addressed in TBD revision 03 (i.e., original finding 7 from SC&A's 2012 review of TBD revision 00 remains open)
- Observation 1: Scaling factor needs clarification

Questions?

References

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