Draft

Advisory Board on Radiation and Worker Health
National Institute for Occupational Safety and Health

A Review of NIOSH's Program Evaluation Report DCAS-PER-087, "Clarksville and Medina Modification Centers"

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Abbreviations and Acronyms

ABRWH, Board	Advisory Board on Radiation and Worker Health
AEC	U.S. Atomic Energy Commission
Be	beryllium
CMC	Clarksville Modification Center
Co	cobalt
d	day
DCAS	Division of Compensation Analysis and Support
DR	dose reconstruction
HHS	U.S. Department of Health and Human Services
hr	hour
Ir	iridium
keV	kiloelectron volt
L-S	lumbar spine
MCNP	Monte Carlo N-Particle Transport Code
MeV	mega-electron volt
MHSMC	Mason & Hanger-Silas Mason Company
MMC	Medina Modification Center
mrem	millirem
NIOSH	National Institute for Occupational Safety and Health
NOCTS	NIOSH DCAS Claims Tracking System
n/p	neutron-to-photon
NTA	nuclear track emulsion, type A
ORAUT	Oak Ridge Associated Universities Team
PER	program evaluation report
PA	posterior-anterior
Po	polonium
POC	probability of causation
SEC	Special Exposure Cohort
TBD	technical basis document
wk	week
yr	year

1 Statement of Purpose

To support dose reconstruction (DR), the National Institute for Occupational Safety and Health (NIOSH) and the Oak Ridge Associated Universities Team (ORAUT) assembled a large body of guidance documents, workbooks, computer codes, and tools. In recognition of the fact that all of these supporting elements in DR may be subject to revisions, provisions exist for evaluating the effect of such programmatic revisions on the outcome of previously completed DRs. Such revisions may be prompted by document revisions due to new information, misinterpretation of guidance, changes in policy, and/or programmatic improvements.

A program evaluation report (PER) provides a critical evaluation of the effects that a given issue or programmatic change may have on previously completed DRs. This includes a qualitative and quantitative assessment of potential impacts. Most important in this assessment is the potential impact on the probability of causation (POC) of previously completed DRs with POCs less than 50 percent.

On March 15, 2021, the Advisory Board on Radiation and Worker Health (Board) tasked SC&A to review DCAS-PER-087, "Clarksville and Medina Modification Centers" (NIOSH, 2019; "PER-087"). In conducting a PER review, SC&A is committed to perform the following five subtasks, each of which is discussed in this report:

- **Subtask 1:** Assess NIOSH's evaluation and characterization of the issue addressed in the PER and its potential impacts on DR. Our assessment intends to ensure that the issue was fully understood and characterized in the PER.

- **Subtask 2:** Assess NIOSH's specific methods for corrective action. When the PER involves a technical issue that is supported by documents (e.g., white papers, technical information bulletins, procedures) that have not yet been subjected to a formal SC&A review, subtask 2 will include a review of the scientific basis and/or sources of information to ensure the credibility of the corrective action and its consistency with current/consensus science. Conversely, if such technical documentation has been formalized and previously subjected to a review by SC&A, subtask 2 will simply provide a brief summary and conclusion of this review process.

- **Subtask 3:** Evaluate the PER's stated approach for identifying the universe of potentially affected DRs, and assess the criteria by which a subset of potentially affected DRs was selected for reevaluation. The second step may have important implications where the universe of previously denied DRs is very large and, for reasons of practicality, NIOSH's reevaluation is confined to a subset of DRs that, based on their scientific judgment, have the potential to be significantly affected by the PER. In behalf of subtask 3, SC&A will also evaluate the timeliness of the completion of the PER.

- **Subtask 4:** Conduct audits of DRs affected by the PER under review. The number of DRs selected for audit for a given PER will vary. (It is assumed that the Board will select the DRs and the total number of DR audits for each PER.)

- **Subtask 5:** Prepare a written report that contains the results of DR audits under subtask 4, along with our review conclusions.

2 Relevant Background Information Pertaining to Facility Operations, Potential Source Terms, and Worker Monitoring Protocols

2.1 Facility operations

The Clarksville Modification Center (CMC) in Clarksville, TN, and the Medina Modification Center (MMC) in San Antonio, TX, were under contract to the U.S. Atomic Energy Commission (AEC) to support nuclear weapons and weapon components maintenance and storage. These sites were two of 13 weapons storage areas created under the Armed Forces Special Weapons Project.

The CMC was constructed on the Fort Campbell Military Reservation in the mid- to late 1940s (the first weapon components arrived in July 1949) and operated from August 1, 1949, through December 31, 1967. The CMC was supported by Sandia National Laboratories, the AEC, and the U.S. Navy, all of which were active at the CMC from 1949 until 1958 performing maintenance and quality assurance on nuclear components of weapons. From 1958 until 1965, Mason & Hanger-Silas Mason Company (MHSMC) operated the CMC for the AEC as a weapons modification and disassembly facility. In August and September 1965, all assembly/disassembly, modification, and maintenance of nuclear weapons was moved to the Pantex Plant. From 1966 to 1967, the AEC continued to operate the CMC in a storage capacity for classified materials, though it is unclear whether additional radiological activities took place during this time.

The MMC was constructed by the U.S. Air Force and the AEC between 1953 and 1955 on the Lackland Air Force Base, with the first weapons components arriving in 1955. However, the approved dates for applicability under the Energy Employees Occupational Illness Compensation Program Act for the MMC are limited to January 1, 1958, through December 31, 1966. The MMC was supported by Sandia National Laboratories for the AEC and the U. S. Air Force through early 1959 to perform maintenance and quality assurance on nuclear components of atomic weapons. From April 1959 until 1966, MHSMC operated the MMC for the AEC as a weapons modification and disassembly facility. The mission was to perform stockpile surveillance, modifications, retrofits, and weapon retirements. This work included inspections for corrosion and replacement of tritium reservoirs. The MMC was operated by MHSMC until January 1966, when its mission was transferred to the Pantex Plant and MMC was transferred back to the U. S. Air Force.

2.2 Source terms

For the CMC, the radioactive materials of interest were tritium as a gas, weapons-grade plutonium, highly enriched uranium, depleted uranium that was used in weapons construction, polonium-210 (Po-210) in a polonium-beryllium (Po-Be) neutron initiator, a cobalt-60 (Co-60) and iridium-192 (Ir-192) radiograph source, and small activities of sealed cesium-137. However, there is a lack of specific radiological information to characterize the source terms that would allow NIOSH to estimate with sufficient accuracy potential internal exposures to these source terms. This resulted in the Special Exposure Cohort (SEC) for the CMC for the period August 1, 1949, through December 31, 1967.

Similar to the CMC, radioactive materials of interest at the MMC include uranium, plutonium, and tritium as well as external exposures to radiography sources such as Co-60 and Ir-192. The primary difference between the CMC and the MMC was that the Po-Be neutron initiators, which present a source of external exposure at CMC, were assumed to have been phased out by the time of covered operations at the MMC. NIOSH's evaluation of SEC-00203 determined there is a lack of specific radiological information to characterize the source terms that would allow NIOSH to estimate with sufficient accuracy potential internal exposures to uranium, plutonium, and tritium. This resulted in the SEC for the MMC for the period January 1, 1958, through December 31, 1966.

2.3 Worker monitoring at the CMC and the MMC

2.3.1 Occupational medical x-rays

Information concerning occupational medical x-ray exposure at the CMC and the MMC is not well documented. A review of the information that is available indicates that one posterior-anterior (PA) x-ray examination and one lumbar-spine (L-S) x-ray exam (consisting of two PA and two lateral views, for men only) was conducted for the period 1960–1967 at the CMC and 1958–1966 at the MMC. X-ray doses are to be assigned according to dose recommendations in ORAUT-OTIB-0006, revision 04[1] (NIOSH, 2011a). Only one assignment during the first year of employment is applicable, and they are not to be applied for each year of employment.

2.3.2 Internal monitoring

NIOSH has concluded that is not possible to reconstruct internal doses completely during the operational period of the CMC or the MMC. Therefore, in the absence of monitoring data for an individual claim, no occupational internal doses should be assigned. For claims in which individual internal monitoring data are available, the internal dose should be reconstructed based on interpretation of the monitoring data using existing NIOSH dose reconstruction processes and procedures. As a result, the U.S. Department of Health and Human Services (HHS) designated a class of CMC and MMC employees for inclusion in their respective SECs (HHS, 2012a, 2012b).

For both the CMC and the MMC, NIOSH evaluated the potential for environmental intakes of material and determined them to only be relevant for potential tritium intakes related to leaks in the nuclear devices. Other potential sources of internal exposure were assumed to be fully encapsulated and thus not likely to represent an intake pathway. NIOSH's evaluation of the magnitude of internal exposure for modeled tritium leaks utilizing documented incidents at Pantex determined that annual doses are less than 1 millirem (mrem) and thus do not need to be included in dose reconstruction.

2.3.3 External monitoring

2.3.3.1 Occupational external environmental dose

Operations at the Pantex Plant were similar to those at the CMC and the MMC and did not result in annual tritium doses greater than 0.001 rem dose; therefore, no environmental tritium dose

[1] ORAUT-OTIB-0006, revision 05, was issued in 2018, which supersedes revision 04. However, revision 04 is used here because this is the revision used in the TBD.

should be assigned. The only other potentially significant external environmental dose at the CMC and the MMC was from radiography sources. Records of environmental dose measurements are not available from the CMC or the MMC. Therefore, a bounding dose from radiography sources was derived by adjusting environmental dose data from the Hanford Radiological Calibration Facility for the CMC and the MMC. The technical basis document (TBD), "Site Profile for Clarksville Modification Center with Supplementary Guidance for the Medina Modification Center," ORAUT-TKBS-0039, revision 03 (NIOSH, 2017; hereafter referred to as the "TBD, revision 03") recommends an annual external environmental dose in table 4-1 (p. 17) of 0.004 rem for the period July 1949–1965, and no environmental external dose assignment after 1965 for the CMC and for the period 1958–1966 for the MMC. Because of the November 13, 1963, high-explosive incident at the MMC, the dose reconstructor should apply an environmental external dose of 0.0023 rem per year after November 13, 1963, according to the TBD, revision 03, page 49.

2.3.3.2 Occupational external dose

External dosimetry records for both the CMC and the MMC are sparse, and the connection between the dose record and the worker might be missing. Statistical analysis of doses that are available cannot be performed with the few records found to date. Therefore, the external co-exposure annual dose recommendations for the Pantex Plant (NIOSH, 2016a) are recommended for the CMC and the MMC. Table B-1, page 51, of ORAUT-TKBS-0039 (NIOSH, 2017) provides the recommended annual photon dose (100 percent 30–250 kiloelectron volts (keV)), neutron dose (100 percent 0.1–2 mega-electron volts (MeV)), and electron dose (100 percent >15 keV electrons) at the 50th percentile and the 95th percentile, applied to the category of worker according to table 6-4, page 26, of the TBD, revision 03.

3 Subtask 1: Identify the Circumstances that Necessitated DCAS-PER-087

3.1 Chronology of events

ORAUT-TKBS-0039, revision 00: On November 14, 2006, NIOSH issued a TBD for the CMC and the MMC, ORAUT-TKBS-0039, revision 00 (NIOSH, 2006), which included an exposure matrix to provide data and guidance for DR of CMC and MMC workers.

OCAS-PER-027: On October 31, 2007, NIOSH issued a PER for the CMC and the MMC, OCAS-PER-027, revision 0 (NIOSH, 2007), which addressed changes in DR procedures for the CMC and the MMC as a result of the issuance of the TBD (NIOSH, 2006). Prior to the TBD, some claims were completed using information developed for the TBD. Some of that information was modified during the TBD comment resolution process, which resulted in an increase in the assigned dose. PER-0027 reevaluated claims impacted by the recently issued TBD.

SC&A's Draft Review of ORAUT-TKBS-0039, revision 00: The Board tasked SC&A to conduct a technical review of revision 00 of ORAUT-TKBS-0039 (NIOSH, 2006). SC&A's (2012) review identified findings that could impact the reconstruction of worker doses. SC&A identified seven finding concerning internal and external DR.

ORAUT-TKBS-0039, revision 01: The Secretary of HHS has designated a class of CMC workers for inclusion in the SEC in recognition of the fact that NIOSH found it lacks sufficient information to reconstruct internal radiation doses adequately for all CMC employees for all potential radiation exposures for the period August 1, 1949, through December 31, 1967. Specifically, this includes internal personnel monitoring data, air monitoring data, process data, and radiological source term information that would allow NIOSH to estimate with sufficient accuracy potential internal exposures to uranium, plutonium, and tritium (HHS, 2012b).

The Secretary of HHS has designated a class of MMC workers for inclusion in the SEC in recognition of the fact that NIOSH found that it lacks sufficient information to reconstruct internal radiation doses adequately for all MMC employees for all potential radiation exposures for the period January 1, 1958, through December 31, 1966. Specifically, this includes internal personnel monitoring data, air monitoring data, process data, and radiological source term information that would allow NIOSH to estimate with sufficient accuracy potential internal exposures to uranium, plutonium, and tritium (HHS, 2012a).

The inability to reconstruct internal doses and the designation of the SEC classes mandated revision 01 of ORAUT-TKBS-0039, which was issued on October 5, 2012 (NIOSH, 2012a).

ORAUT-TKBS-0039, revision 02: On April 8, 2013, NIOSH issued revision 02 of the CMC and MMC site profile (NIOSH, 2013). Changes incorporated into revision 02 of ORAUT-TKBS-0039 include clarification of guidance for assigning external dose in section A.6 and table A-1 and updated section 1.0 text.

ORAUT-TKBS-0039, revision 03: On January 4, 2017, NIOSH issued revision 03 of the CMC and MMC site profile (NIOSH, 2017). Changes incorporated into revision 03 of ORAUT-TKBS-0039 include the following:

- Updated external dose reconstruction guidance due to revisions in ORAUT-TKBS-0013-6, "Pantex Plant – Occupational External Dose," revision 03 (NIOSH, 2016a)
- Revised external dose sections 6.2, 6.2.1, 6.2.2.2, 6.2.5.1, 6.3, 6.3.1, and 6.3.2
- Added recommended external co-exposure doses in Attachment B.
- Updated table B-1 (p. 51) to incorporate values from tables A-1 through A-3 of the Pantex Plant occupational external dose TBD (NIOSH, 2016a)
- Updated references

DCAS-PER-087: Earlier revisions to the TBD primarily resulted in decreases (or no change) to dose estimates. The largest change involved the elimination of some exposures due to the inclusion of the CMC and the MMC in SECs, which did not require issuance of a PER. However, on January 18, 2019, NIOSH issued DCAS-PER-087 (NIOSH, 2019) to address changes in DR procedures for the CMC and the MMC that resulted from the January 4, 2017, issuance of revision 03 of the TBD (NIOSH, 2017). The three issues addressed in PER-087 were as follows:

1. Dose to the liver, gallbladder, spleen, pancreas, bone surfaces, stomach and remainder organs all increased for L-S x-ray examinations due to a change in the surrogate organ selected for that view. ORAUT-TKBS-0039, revision 00 (NIOSH, 2006), table 3-2 (p. 19), recommends using L-S exam doses as listed in ORAUT-OTIB-0006, revision 03 PC-1 (NIOSH, 2005), which used the esophagus as the surrogate organ for the liver, gallbladder, spleen, pancreas, bone surfaces, stomach, and remainder organs. However, ORAUT-OTIB-0006, revision 04 (NISOH, 2011a), recommends using the ovary as the surrogate organ for the liver, gallbladder, spleen, pancreas, bone surfaces, stomach, and remainder organs for L-S exams.

2. Dose to lower torso organs may increase for some workers due to establishing a scaling factor for workers who held weapon pits in their laps in the sitting position. The DR procedure is outlined in section 6.4 (pp. 26–27) of the TBD, revision 03, which recommends use of DCAS-TIB-0013, revision 1 (NIOSH, 2010), and DCAS-TIB-0010, revision 04 (NIOSH, 2011b), with a scaling factor as provided on page 27 of the TBD, revision 03.

3. Unmonitored external shallow dose increased for all years due to the incorporation of ORAUT-OTIB-0086, revision 01 (NIOSH, 2016b), into the Pantex TBD, ORAUT-TKBS-0013-6 (NIOSH, 2016a). This change introduced Pantex external co-exposure doses, as discussed in section 6.3.1 (p. 25) of revision 03 the TBD.

With 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.

3.2 SC&A's comments

SC&A's reviewed ORAUT-TKBS-0039, revision 00, in 2012 (SC&A, 2012). SC&A identified seven findings concerning internal and external dose reconstruction that could impact the reconstruction of worker doses.

Most of the previous changes in CMC and MMC documents resulted in no additional, or deceased, dose assignment; therefore, revision 00 of the TBD was the only document previously reviewed by SC&A until the current review of revision 03 of the TBD and PER-087.

There are no findings pertaining to subtask 1.

4 Subtask 2: Assess NIOSH's Specific Methods for Corrective Action

4.1 Previous findings

SC&A reviewed ORAUT-TKBS-0039, revision 00 (NIOSH, 2006), and issued its report on February 22, 2012. SC&A identified the following seven findings (SC&A, 2012):

1. Unsupported assumptions for modeling depleted uranium exposures
2. Potential thorium exposure pathway not addressed for Medina Plant

3. Use of Pantex tritium dose experience as surrogate for upper bound for Clarksville/Medina Plants is questionable
4. N/P ratio method cited has been replaced with correction factor for NTA film coupled with MCNP-based estimate for missed doses below 0.5 MeV energy threshold; however, questions remain
5. Inadequate consideration of potential exposures resulting from handling of "broken arrows"
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
7. Lack of dose records and source term characterization data for Clarksville/Medina leads to use of inadequately justified surrogate data

All these findings involving internal doses have been rendered moot by the designation of an SEC class for all employees at Clarksville and Medina for the operational years in question due to the inability to reconstruct internal doses (NIOSH, 2012b; HHS, 2012a, 2012b).

For partial external dose reconstruction, findings 4, 6, and 7 remain.

For finding 4, regarding use of a correction factor in place of a neutron-to-photon (n/p) ratio method for nuclear track emulsion, type A (NTA) film (SC&A 2012, p. 22), SC&A noted that NIOSH was moving to a different approach to the issue in its Pantex review:

> Accordingly, NIOSH has moved from its former n/p ratio approach to one of estimating neutron dose at Pantex for 1952 to 1977 by applying a correction factor. The correction factor consists of three elements, including (1) correction for the energy threshold of NTA film, (2) angular response of NTA film, and (3) NTA track fading. NIOSH proposes to apply the MCNP program to determine the fraction of the neutron dose equivalent that would fall below a 0.5 MeV threshold. [SC&A, 2012, p. 22]

However, for the application of the Monte Carlo N-Particle Transport Code (MCNP) program, SC&A had questions regarding its application to address NTA track fading, including the impact of thicker moderators, proximity of workers handling components, dosimetry geometry, and presence of multiple units. SC&A summarized:

> Most importantly, NIOSH needs to demonstrate how its proposed parameters for MCNP will result in a bounding neutron dose estimate for the range of systems assembled and disassembled for the period of 1951–1991 at Pantex, as well as the years of operations at Clarksville and Medina. [(SC&A, 2012, p. 23]

For finding 6 (and finding 7, insofar as it addresses overall use of surrogate data from Pantex) concerning external dose, SC&A was concerned about the lack of CMC and the MMC external dose records and the dosimetry uncertainty for records that were available. Specifically, SC&A found that:

> While the similarity of the source terms involved is acknowledged, SC&A finds the back-extrapolation of surrogate data to unduly "stretch" the enabling criteria later defined by the Advisory Board for such an approach. There is no objective information provided to substantiate that the handling of components during surveillance and maintenance activities in 1949–1958 at Clarksville presented a comparable upper bound dose as the period 1952–1958 at Pantex (240 mrem/yr at 95th percentile for unmonitored workers). In the latter case, plant construction and startup activities dominated the early part of the period in question, which would have limited potential radiation exposure, whereas at the modification centers, actual systems and components were being directly handled from the beginning. [SC&A, 2012, p. 12]

SC&A concluded:

> While NIOSH has assigned the higher dose value of 1,040 mrem/yr from 1959–1960 at Pantex for Clarksville Group 1 workers, the basis for applying any Pantex annual dose as a surrogate bounding dose for Clarksville and Medina should be re-examined in the context of current surrogate data policies. [SC&A, 2012, p. 12]

4.2 SC&A's comments concerning previous findings

As previously indicated, most of SC&A's findings about the site profile were resolved by the CMC and the MMC SECs. In regard to finding 4, in subsequent NIOSH reviews, the MCNP approach was supplanted by use of correction factors. The 2017 revision of the Clarksville site profile (NIOSH, 2017) cites the 2016 revised external dose TBD for Pantex and applies correction factors for recorded NTA film results to account for threshold response (1.4), angular dependence (1.33), and uncorrected fading (1.56) (NIOSH, 2016a). Combining these factors, NIOSH recommends that a total correction factor of 2.9 should be applied to the NTA film results in addition to the International Commission on Radiological Protection correction factor of 1.91 (NIOSH, 2016a). These correction factors were conservatively developed for the breadth of Pantex operations over years of operation that envelope those of Clarksville and Medina and, on that basis, resolve SC&A's questions regarding scope of coverage.

SC&A is satisfied with this resolution.

SC&A noted that the TBD, revision 03, recommends using the NTA film recorded results with a correction factor of 2.9, as opposed to previous versions of the TBD that recommended deriving neutron dose using the n/p ratio method. This could potentially result in an increase in derived neutron dose for some energy employees. However, all the previous claims were reworked per PER-087, using revision 03 of the TBD and ORAUT-OTIB-0086; therefore, changes in neutron dose assignments were accounted for.

In regard to finding 6 concerning external dose, all the previous claims were reworked per PER-087, using revision 03 of the TBD and OTIB-0086; therefore, changes in external dose assignments were accounted for.

Finding 1. TBD, revision 00, finding 7 regarding use of surrogate data for Clarksville not adequately addressed in TBD, revision 03

It does not appear that TBD, revision 03, reflects any substantiation regarding the applicability of Pantex surrogate dose data as bounding for unmonitored Clarksville workers in the early years (e.g., 1958–1965), when Clarksville was fully operational while Pantex had operations that were coming online. The basis for applying surrogate Pantex data continues to be that "operations at Clarksville Modification Center between 1958 and 1965 were similar to those at the Pantex Plant; MHSMC operated both facilities" (NIOSH, 2017, p. 25). Therefore, SC&A recommends that the original finding 7 remain open.

4.3 Technical changes in the TBD, revision 03

The three technical issues addressed in the TBD, revision 03, that sequentially resulted in the issuance of PER-087 were as follows:

1. **Surrogate organ –** The surrogate organ for the dose to the liver, gallbladder, spleen, pancreas, bone surfaces, stomach, and remainder organs for L-S x-ray examinations was changed from the esophagus to the ovary.

2. **Pits in lap adjustment –** Section 6.4 (pp. 26–27) of the TBD, revision 03, recommends a scaling factor be applied to the glovebox correction factor for workers who held weapon pits in their laps in the sitting position. The TBD, revision 03, recommends use of DCAS-TIB-0013, revision 1 (NIOSH, 2010), and DCAS-TIB-0010, revision 04 (NIOSH, 2011b), and a scaling factor of 0.125.

3. **Shallow dose –** The TBD, revision 03, section 6.3.1 (p. 25), recommends using the Pantex external dose TBD, ORAUT-TKBS-0013-6, revision 03 (NIOSH, 2016a), for assignment of shallow dose.

4.4 SC&A's evaluation of the technical changes in the TBD, revision 03

SC&A's evaluation of the three technical issues addressed in the TBD, revision 03, and sequentially in PER-087 were as follows:

1. **Surrogate organ –** ORAUT-OTIB-0006, revision 03 PC-1 (NIOSH, 2005), used the esophagus as the surrogate organ for L-S x-ray exams of the liver, gallbladder, spleen, pancreas, bone surfaces, stomach, and remainder organs. However, ORAUT-OTIB-0006, revision 04 (NISOH, 2011a), recommends using the ovary as the surrogate organ for L-S x-ray exams of the liver, gallbladder, spleen, pancreas, bone surfaces, stomach, and remainder organs. Therefore, SC&A finds this change in the TBD, revision 03, and included in PER-087 to be correct.

2. **Pits in lap adjustment –** SC&A evaluated the recommendation of a scaling factor of 0.125 as recommended on page 27 of TBD, revision 03. 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 the TBD, revision 03 (NIOSH, 2017):

> Assuming that the claimant actually performed pit handling maintenance operations for 1 hr/d 5 d/wk [1 hour per day and 5 days per week], the appropriate correction to apply would equate to the **95th-percentile correction multiplied by 0.125** (5 hr/d divided by the 40-hour work week). [Emphasis added.]

Multiplying the 95th-percentile glovebox correction factor (2.19) by 0.125 equals 0.27, which would lower the actual dose assigned.

Observation 1: Scaling factor needs clarification

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

$$\text{Scaling factor} = ((1.0 \times 7/8) + (2.19 \times 0.125)) = 1.15$$

3. **Shallow dose** – SC&A concurs that ORAUT-OTIB-0086, revision 01 (NIOSH, 2016b), should be used for assignment of shallow dose, as per the Pantex external dose TBD, ORAUT-TKBS-0013-6, revision 03 (NIOSH, 2016a, p. 41), because external dose assignments for the CMC and the MMC are modeled after the Pantex Plant.

5 Subtask 3: Evaluate the PER's Stated Approach for Identifying the Number of DRs Requiring Reevaluation of Dose

5.1 NIOSH's selection criteria

Section 3.0 of DCAS-PER-087 described the following criteria NIOSH used to identify previously completed claims requiring reevaluation using guidance in revision 03 of ORAUT-TKBS-0039 (NIOSH, 2017) and mandated by DCAS-PER-087 (NIOSH, 2019):

- A search of the NIOSH DCAS Claims Tracking System (NOCTS) database was combined with a text search of the DR reports of previously completed claims. The NOCTS search queried employment at either site, while the text search queried the keywords "Clarksville" or "Medina." The combined search resulted in a total of 172 claims.

- NIOSH then removed 122 claims from this list for the following reasons:

  – 51 claims were removed from this list because the previous evaluation of the claims yielded POC values ≥50 percent.

  – 17 claims were removed because they had been "pulled" from DR primarily due to inclusion in the SEC.

  – 32 claims were removed because their information indicated they would qualify for compensation under the SEC and no estimate for medical benefits would be necessary for other cancers.

- 11 claims were removed for which the keyword search flagged a word that was not actually associated with the site, or the claim was duplicated between different searches.

- 11 claims were removed that are being evaluated under a PER for the Pantex site. The evaluation under that PER will consider all changes to the DR methods, not just changes to the Pantex site.

Dose for the remaining 50 claims was recalculated using revision 03 of the TBD as well as all other applicable procedures. All 50 claims resulted in a new POC below 45 percent.

NIOSH provided the U. S. Department of Labor with the list of all the claims evaluated under this PER. Since none resulted in a POC greater than 50 percent, NIOSH did not request the return of any claims.

5.2 SC&A's comments

The selection criteria used by NIOSH for previously completed DRs that require reevaluation under DCAS-PER-087 are valid. There are no findings associated with subtask 3.

6 Subtask 4: Conduct Audits of a Sample Set of Reevaluated DRs Mandated by DCAS-PER-087

Previous sections of this report described changes introduced in revision 03 of the CMC and MMC site profile (NIOSH, 2017) that could increase the dose assigned for the periods covered for these sites.

For SC&A to satisfy its commitment under subtask 4, at least one DR may 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 exam dose, lower torso dose due to handing weapons pits in the lap, and external shallow dose. If all of these exposures cannot be located in a single DR for each site, then additional DRs that do contain these elements will be needed.

7 References

National Institute for Occupational Safety and Health. (2005). *Dose reconstruction from occupationally related diagnostic x-ray procedures* (ORAUT-OTIB-0006, rev. 03 PC-1). https://www.cdc.gov/niosh/ocas/pdfs/arch/tibs/or-t6-r3-p1.pdf

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