



Review of DCAS-PER-051 for the Weldon Spring Plant, Weldon Spring, MO

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Weldon Spring site profile revisions that triggered PER-051

- ◆ ORAUT-TKBS-0028-3 (TBD-3), occupational medical dose, rev. 01, issued January 30, 2013
- ◆ ORAUT-TKBS-0028-4 (TBD-4), occupational environmental dose, rev. 01, issued May 17, 2013
- ◆ ORAUT-TKBS-0028-5 (TBD-5), occupational internal dose, rev. 01, issued March 15, 2013; rev. 02, issued May 21, 2013
- ◆ ORAUT-TKBS-0028-6 (TBD-6), occupational external dose, rev. 01, issued February 6, 2013
- ◆ DCAS-PER-051, “Weldon Spring Plant,” issued March 4, 2015, to address changes in dose reconstruction (DR) procedures using the revised site profile documents

Weldon Spring facilities

- ◆ Weldon Spring Plant (WSP), Weldon Spring Quarry (WSQ), and the Weldon Spring Raffinate Pits (WSRP)
- ◆ Referred to as the “Weldon Spring Plant” in general
- ◆ Operated by the U.S. Atomic Energy Commission as a feed materials plant to process uranium and thorium ore by the Uranium Division of Mallinckrodt Chemical Works

Four periods of site operations

1. **Site acquisition and development:** 1954–1957
2. **Operational:** 1957–1966
3. **Post-operational:** 1967–1985. U.S. Department of Defense (DOD), not the U.S. Department of Energy (DOE), controlled:
 - WSP during the post-operational period 1967–1985
 - WSRP and WSQ during 1967–1974
4. **Remediation:** 1985–2002

EEOICPA coverage

- ◆ WSP employment is covered:
 - Operational period (1957–1966)
 - Remediation period (1985–2002)
- ◆ WSQ and WSRP employment is covered:
 - Operational period (1957–1966)
 - Post-operational period (1975–1984)
 - Remediation period (1985–2002)

Radionuclides of dose significance

- ◆ Natural uranium (NU) processed 1957–1962
- ◆ After 1962, all uranium is assumed to be enriched to 1%
- ◆ Natural thorium
- ◆ Recycled uranium (RU) was processed beginning in 1961
- ◆ Radon-222 and radium-228 considered to be potentially significant for DR

Internal monitoring

- ◆ **Operational period (1957–1966):** uranium urine bioassays, no records of thorium monitoring
- ◆ **Post-operational period (1967–1985):** no DOE contract personnel bioassay monitoring appears to have been conducted during this period
- ◆ **Remediation period (1985–2002):** extensive bioassay monitoring program was conducted from 1991 to 2001

External monitoring

- ◆ **Operational period (1957–1966):** Employees in radiological areas were monitored. No ambient exposure rates recorded during the operational period.
- ◆ **Post-operational period (1967–1985):** No record of external monitoring for DOE contract personnel. No site surveys until 1982, except for a 1975 aerial radiological survey. Site external ambient exposure monitoring began in 1982.
- ◆ **Remediation period (1985–2002):** Personnel external monitoring was provided during the remediation period.

DCAS-PER-051 for Weldon Spring ORAUT-TKBS-0028-3, -4, -5, and -6

- ◆ There were several technical basis document (TBD) changes that covered all operational time periods and job types. Therefore, no claims were excluded from further evaluation based on job types or employment period.
- ◆ Changes included:
 - Change in assumed isotopic ratios for uranium ore concentrates
 - Addition of a neutron-to-photon ratio
 - Addition of a geometry correction factor for external dose
 - Addition of a thoron exposure dose
 - Change in RU contaminate fractions
 - An increase in the radon exposure estimate.

SC&A's review of PER-051

- ◆ **February 16, 2023:** The Subcommittee for Procedure Reviews (SPR) tasked SC&A to review DCAS-PER-051, “Weldon Spring Plant.”
- ◆ **August 10, 2023:** SC&A issued “A Review of NIOSH’s Program Evaluation Report DCAS PER-051, ‘Weldon Spring Plant.’”
- ◆ **September 21, 2023:** SC&A issued revision 1 of “A Review of NIOSH’s Program Evaluation Report DCAS PER-051, ‘Weldon Spring Plant.’”

SC&A's subtask 1 review of PER-051

- ◆ **Subtask 1:** Identify the circumstances that necessitated PER-051.
- ◆ SC&A reviewed rev. 01 of TBD-3, TBD-4, and TBD-6; rev. 02 of TBD-5; and PER-051.
- ◆ SC&A found that PER-051 addressed the changes in these revisions that could potentially result in increases in internal and external dose assignments.
- ◆ Additional changes in the revisions were for other purposes and did not result in a potential increase in assigned dose.
- ◆ SC&A had no findings but did have one observation for ORAUT-TKBS-0028-6 pertaining to subtask 1.

SC&A's observation for subtask 1

Observation 1: Use of neutron-to-gamma ratio

Section 2.0 of PER-051 states that the revisions to the TBDs included the addition of a neutron-to-photon ratio. However, it appears that revision 00 of ORAUT-TKBS-0028-6 (2005) contains the same neutron-to-photon ratio recommendations as revision 01 (2013), as follows:

Using the results of gamma and neutron dose rate measurements performed on depleted and low enriched UF₄ [uranium tetrafluoride] drums, a neutron-to-gamma ratio was developed. . . . The results of this analysis were that a neutron-to-gamma ratio of 0.1, lognormally distributed with a geometric standard deviation of 1.71 and an upper 95% ratio limit of 0.23, should be applied in those areas where there is the potential for neutron dose from uranium fluoride compounds.

NIOSH's review of claims under PER-051

- ◆ NIOSH issued rev. 00 of TBD-3, TBD-4, and TBD-6 in 2005, and rev. 01 in 2013.
- ◆ NIOSH issued rev. 00 of TBD-5 in 2005, and rev. 01 and 02 in 2013.
- ◆ Under PER-051, NIOSH reevaluated all noncompensated claims using the current version of the TBDs; therefore, NIOSH did not address specific changes in rev. 01 compared to rev. 00 (or rev. 02 compared to rev. 00 or 01 for TBD-5) that could lead to an increase in assigned dose.

SC&A's subtask 2 review of PER-051

- ◆ **Subtask 2:** Assess NIOSH's specific methods for corrective action, including a review of TBD-3, TBD-4, TBD-5, and TBD-6.
- ◆ SC&A had previously reviewed rev. 00 of TBDs-3–6 in 2009.
- ◆ Rev. 01 of TBDs-3–6, and rev. 02 of TBD-5 had not been reviewed by SC&A.
- ◆ SC&A's review of Weldon Spring TBDs included 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.

SC&A's review of sections 3–6 of 2013 TBD

- ◆ Determined if the revisions contained technically correct methodology and information.
- ◆ Evaluated appropriate references as needed.
- ◆ Analyzed changes that could decrease or increase assigned dose.
- ◆ Did not identify any findings or observations concerning sections 3–6 of the 2013 Weldon Spring TBD.
- ◆ Summarized the changes that have the potential to increase assigned dose in section 3.2 of SCA's report.

SC&A's comments on subtask 2

- ◆ SC&A confirmed that the 2013 revisions incorporated in Weldon Spring TBD-3, TBD-4, TBD-5, and TBD-6 were scientifically sound.
- ◆ SC&A finds NIOSH corrective actions to be appropriate since NIOSH reevaluated all Weldon Spring noncompensated claims and reworked the applicable claims using the revised TBDs.
- ◆ There are no findings associated with subtask 2.

SC&A's subtask 3 review of PER-051

- ◆ **Subtask 3:** Evaluate the PER's stated approach for identifying the number of DRs requiring reevaluation of dose
- ◆ NIOSH created a database to search for all claims using the search terms "Weldon Spring Plant," "Weldon Spring Raffinate Pits," and "Weldon Spring Quarry" to develop a list of all claims that may have had employment at the Weldon Spring site.
- ◆ The original search resulted in 286 potentially affected claims.

Subtask 3: Removal of DRs not requiring reevaluation of dose

- ◆ NIOSH removed 174 claims for the following reasons:
 - 4 claims: DRs were completed using the revised TBDs
 - 5 claims: pulled from DR by the U.S. Department of Labor (DOL)
 - 112 claims: previous DR resulted in a POC of $\geq 50\%$
 - 46 claims: part of Mallinckrodt Special Exposure Cohort (SEC)
 - 2 claims: no verified Weldon Spring employment and DR did not use Weldon Spring TBDs
 - 2 claims: employment only included the construction period prior to the start of any radiological operations
 - 3 claims: removed prior to being evaluated further for the following reasons:
 - 1 claim: met the Mallinckrodt SEC criteria
 - 1 claim: employment was outside the covered period for the site
 - 1 claim: returned to NIOSH for a new DR for other reasons, will be revised using the current TBDs

Subtask 3: Evaluation of remaining claims

- ◆ Dose for the remaining 112 claims was recalculated using the current revisions of the TBDs and other applicable documents. The reevaluation found:
 - 101 claims: The resulting POC was below 45%.
 - 8 claims: Resulted in a POC greater than 50%. NIOSH will request that DOL return the eight claims for reevaluation.
 - 3 claims: Had a POC between 45% and 50%. For those 3 claims, the Interactive RadioEpidemiological Program was run 30 times at 10,000 iterations per NIOSH procedures, and the resulting POC was still less than 50% for each claim.

Subtask 3: SC&A's evaluation of selection process

- ◆ SC&A found that the selection criteria used by NIOSH for previously completed DRs that required reevaluation under PER-051 are reasonable.
- ◆ SC&A had no findings but did have one observation associated with subtask 3.

SC&A's observation for subtask 3

Observation 2: Eliminating claims due to being reevaluated under an SEC

PER-051 indicates that 46 of the claims were removed from the reevaluation list because the energy employees also had employment at Mallinckrodt and were part of the SEC at that facility. However, a claim may also have a non-SEC cancer that would need to be reevaluated using the revised Weldon Spring documents for medical coverage. How does NIOSH assure that a claim does not have additional non-SEC cancers before removing it from consideration under a PER?

SC&A's subtask 4 review of PER-051

Subtask 4: Conduct audits of a sample set of reevaluated DRs mandated by PER-051

SC&A suggests that 2–3 DR claims be selected for review from the WSP site during the operational period (1957–1966). Since the TBDs have undergone major revisions, a complete DR review will be performed. SC&A suggests that the selection process should attempt to include the following criteria:

1. occupational medical x-rays with skin cancer(s)
2. environmental intakes consisting of exposure to uranium, thorium, and RU contaminants
3. environmental external ambient exposure
4. internal intakes consisting of exposure to uranium ore concentrates, thorium, RU contaminants, thoron, and radon
5. external photon dose for an operator, material handler, or trade worker

Summary of SC&A's evaluation of site profile

- ◆ SC&A's review of ORAUT-TKBS-0028-3, -4, and -6, rev. 01, identified no findings or observations.
- ◆ SC&A's review of ORAUT-TKBS-0028-5, rev. 02, identified no findings or observations.

Summary of SC&A's evaluation of PER-051

- ◆ SC&A's review of PER-051 identified no findings and two observations:
 - **Observation 1:** Use of neutron-to-gamma ratio
 - **Observation 2:** Eliminating claims due to being reevaluated under an SEC
- ◆ SC&A requests that:
 - NIOSH select appropriate claims for review under subtask 4
 - The SPR task SC&A with the evaluation of selected claims



Questions?