Review of Program Evaluation Report DCAS-PER-069, "Jessop Steel Company"

Amy Mangel, MS, Certified Health Physicist, SC&A, Inc.

Advisory Board on Radiation and Worker Health,
Subcommittee for Procedure Reviews

June 5, 2026

DCAS-PER-069 (“PER-069”) purpose

Address the impacts on previously completed cases of issuing revision 1 of the technical basis document (TBD) for Jessop Steel Company (Jessop), which is Appendix BL of Battelle-TBD-6000 (“TBD-6000”)

Jessop background

- Located in Washington, Pennsylvania, and made stainless steel piping for Fernald using uranium-contaminated nickel scrap
- Request for 2 tons of nickel scrap was dated December 2, 1952
  - 1 ton sent the week of December 5, 1952
  - Second ton believed sent soon after
- Material was in the form of nickel trays from Lake Ontario Storage Area and likely originated from Harshaw Chemical Company
- Also sheared an unknown number of uranium plates for DuPont on March 2, 1954
- No residual contamination period after March 1954 due to low potential for contamination

Jessop timeline

- Energy Employees Occupational Illness Compensation Program Act of 2000 covered period from December 1, 1952, through March 31, 1954
- No residual period after 1954
  - Potential for contamination was determined to be low

Subtask 1: Changes necessitating program evaluation report (PER)

Revision 1 of Appendix BL included changes based on revisions to TBD-6000

- Incorporates changes made to TBD-6000 as well as changes to make the dose estimate more consistent with existing techniques
  - Eliminated job categories for internal and external dose estimates
  - Increase in inhalation intakes

Subtask 2: Assess corrective action methods

- SC&A has not previously evaluated Appendix BL
- SC&A's review of PER-069 includes an evaluation of Appendix BL, revision 1, for its guidance on dose reconstruction

Occupational internal dose – nickel activities

- The National Institute for Occupational Safety and Health (NIOSH) did not find any data for airborne uranium contamination at Jessop
- Because Huntington Pilot Plant operations were similar to those at Jessop, NIOSH used the 95th percentile airborne nickel concentrations at Huntington Pilot Plant
  - Assumed 1% uranium by weight, 2% enriched uranium
  - Assumed scrap nickel work took a full week (44 hours)
  - Total inhaled activity of 622 disintegrations per minute (dpm)

Occupational internal dose – after nickel activities

- NIOSH used TBD-6000 to calculate surface contamination level based on assumed air concentration
  - Assumed airborne contamination settled for 44 hours
    - 1,399 disintegrations per minute per square meter (dpm/m^2)
  - Resuspension factor of 1E-05 per meter (m^{-1})
    - Airborne concentration of 0.014 disintegrations per minute per cubic meter (dpm/m^3)

Occupational internal dose – plate shearing

- NIOSH used TBD-6000, table 7.5, for cutoff, milling, and slotting as a claimant-favorable assumption
  - Believed to produce a higher airborne activity than shearing
    - Used 95th percentile of the distribution
    - Assumed shearing took place for one full day (8.8 hours)
      - Total inhalation of 6,706 dpm

Occupational internal dose – after plate shearing

- NIOSH used TBD-6000 to calculate surface contamination level based on assumed air concentration
  - Assumed airborne contamination settled for 24 hours (three full shifts)
    - 41,148 dpm/m^2
  - Added to surface contamination level from shearing
    - Total of 42,547 dpm/m^2
  - Resuspension factor of 1E-05 m^{-1}
    - Airborne concentration of 0.425 dpm/m^3

Occupational internal dose – ingestion

- NIOSH calculated ingestion rates from the assumed surface contamination levels using the U.S. Nuclear Regulatory Commission's NUREG/CR-5512
  - Did not use OCAS-TIB-0009, as the timeframes at Jessop are significantly less than the 30 days assumed in OCAS-TIB-0009
  - Ingestion rates presented in table 2 of Appendix BL, revision 1

SC&A comments on occupational internal dose – nickel scrap

- SC&A also unable to identify airborne uranium data for Jessop
  - Agrees with NIOSH's determination to use Huntington Pilot Plant TBD
- SC&A confirmed the total inhaled activity of 622 dpm; surface contamination of 1,399 dpm/m^2; and resuspended airborne concentration of 0.014 dpm/m^3

Observation 1

Assumed exposure time may be underestimated

- Memo dated December 2, 1952, which requested 2 tons of nickel scrap sent to Jessop
- Weekly progress report for week of December 5, 1952, states 1 ton was sent to Jessop
- NIOSH presumes the second ton was sent soon after the first ton
- Time period for dose assessment was 1 week
  - If 1 ton sent during the first week of December 5, 1952, and the second ton sent after, it would be reasonable to assume the total time for scrap nickel operations was 2 weeks
- SC&A reviewed operational reports and did not locate information confirming when Jessop received the second ton of material
- In the absence of information stating that nickel scrap work at Jessop did not proceed until both tons of material were received, SC&A believes it is more claimant-favorable to assume the work took 2 weeks

SC&A comments on occupational internal dose – plate shearing

- SC&A agrees that NIOSH's assumption of 24 hours for settling of airborne contamination from plate shearing is claimant-favorable
- SC&A confirmed surface contamination of 41,148 dpm/m^2 and resuspended airborne concentration of 0.425 dpm/m^3

Observation 2

Additional information should be included to use surrogate uranium operational data and modeling

- NIOSH stated air concentrations associated with uranium cutoff, milling, and slotting from table 7.5 of TBD-6000 were expected to be higher than what would be expected from shearing
- SC&A requests additional information or references to support this assumption

Observation 3

Clarification on assumed work hours

- Unclear how the values in the “Other work hours” column of table 1 in Appendix BL, revision 1, were calculated for December 1952 and January through March 1954
  - Assuming 8.8 hours per workday, as assumed in other calculations, does not yield whole days
- SC&A requests clarification on how these values were determined

Occupational external dose estimate – dose rate factor

- No occupational external data at Jessop. NIOSH used TBD-6000
  - NIOSH adjusted dose rates for uranium metal to reflect nickel scrap that was 1% uranium by weight, 2% enriched
    - Specific activity of 2% enriched uranium 1,200 picocuries per milligram (pCi/mg); nickel scrap assumed to be 12 pCi/mg
  - NIOSH divided assumed specific activity of nickel scrap by specific activity of natural uranium
    - 12 pCi/mg divided by 684 pCi/mg
      - Factor of 0.0175 to reduce TBD-6000 dose rates

Occupational external dose estimate – uranium

- Highest 1-foot photon dose rate from table 6.1 of TBD-6000 (2.08 millirem per hour (mrem/hr))
  - 1-foot beta dose rate assumed to be 10 times higher
  - Contact beta dose rate 230 mrem/hr
- NIOSH applied the reduction factor of 0.0175
  - 1-foot photon dose rate, 1-foot beta dose rate, and contact beta dose rate of 0.036 mrem/hr, 0.36 mrem/hr, and 4.04 mrem/hr, respectively
- NIOSH cited a Harshaw Chemical survey that showed a surface dose rate of 0.06 mrem/hr gamma and 1.94 mrem/hr beta plus gamma
  - NIOSH's assumed dose rates comparable and favorable
  - Assumed exposure for 44 hours in December 1952
- For uranium plate shearing, NIOSH used TBD-6000, table 6.1, and assumed workers exposed for half of the day

Occupational external dose estimate – after uranium activities

- NIOSH used surface contamination levels and dose conversion factors from TBD-6000, table 3.10
  - Applied these dose rates to the time period between uranium operations

SC&A comments on external dose estimate

- Also did not find external dose data for Jessop
  - Agrees with NIOSH's determination to use TBD-6000
- Was able to match the reduction factor of 0.0175

Observation 4

Clarification for adjustments for shielding in external dose modeling

- Revision 0 of Appendix BL also considered the difference in atomic numbers of nickel and uranium for shielding purposes
  - Reduction factor of 0.0549, instead of 0.0175
- SC&A requests clarification on how it was determined that the difference in atomic number and shielding effectiveness was no longer necessary in calculating the reduction factor

Additional SC&A comments on external dose estimate

- SC&A verified the calculated 1-foot photon dose rate, 1-foot beta dose rate, and contact beta dose rate of 0.036 mrem/hr, 0.36 mrem/hr, and 4.04 mrem/hr, respectively
- Assumption that the operator spend 50% of their workday a distance of 1 foot from the metal is in accordance with section 6.2 of TBD-6000

Residual contamination

- Residual contamination potentially existed at Jessop between uranium operations and after
- Uranium work was limited; therefore, the potential for contamination to remain after operations was low
- Doses not assigned after March 1954
- SC&A agrees with NIOSH's determination
  - Potential doses after uranium operations would be minimal from a dose reconstruction perspective

Occupational medical dose

- No site-specific guidance for Jessop occupational medical dose
- Use ORAUT-OTIB-0006 to assign occupational medical dose
- SC&A agrees with the guidance to use ORAUT-OTIB-0006 in the absence of site-specific information

Subtask 3: PER selection criteria

- All completed claims with verified employment at Jessop with a probability of causation (POC) less than 50%
  - 8 claims
- All 8 claims reevaluated using revision 1 of Appendix BL
  - All had POC less than 45%
- SC&A agrees with NIOSH's selection criteria and that all potentially affected claims were captured
- PER was conducted in a timely manner
  - Revision 1 of Appendix BL issued in October 2015
  - PER-069 issued in April 2016

Subtask 4: Audit of reevaluated dose reconstructions

- SC&A recommends that the Advisory Board on Radiation and Worker Health select the appropriate number of cases to assess changes introduced in revision 1 of Appendix BL:
  - Internal dose
  - External dose
  - Residual internal and external dose between uranium operations

Questions?