Update on SEC-00247- Superior Steel Co.

Paul Ziemer, Ph.D.
Megan Lobaugh, Ph.D.

134th Meeting of the Advisory Board on Radiation and Worker Health
26-27 August 2020
Overview

- Review of the Superior Steel Co.
- Review of the SEC-00247 Evaluation Report
- Responses to the SC&A Review of the SEC-00247 ER
Review of the Superior Steel Co.
About Superior Steel Co. Site

- Carnegie, PA
  - 5 interconnected buildings
- Uranium rolling for AEC
- Covered Period
  - **AWE**: January 1, 1952 through December 31, 1957
  - **Residual Radiation**: January 1, 1958 through present

*Photo from USACE, 2018*
Superior Steel Co. Processing Areas

From Myrick, 1981

[Diagram showing processing areas: Storage Shed, AREA C, Rolling area, Finishing Stands, AREA A, Roughing Mill, AREA B, Salt Bath.]
Review of the SEC-00247 Evaluation Report
SEC-00247 Petition for Superior Steel Co.

- 83.13 (Form B) Petition received May 1, 2018
  - (F.1) Basis: Radiation exposures potentially incurred by members of the proposed class were not monitored either through personal monitoring or through area monitoring.

- Petition qualified for review on July 19, 2018
  - Class under Review: All atomic weapons employees who worked in any area at Superior Steel Co. in Carnegie, PA during the period from January 1, 1952 through December 31, 1957.
**Evaluation of Petition Basis - Internal Monitoring**

- “Individual uranium urinalysis data are unavailable for Superior Steel workers and none are known to exist.” (ORAUT-TKBS-0034)
  - When personal internal monitoring data are unavailable, NIOSH uses air monitoring data from worker breathing zones and work areas, in accordance with NIOSH’s OCAS-IG-002, *Internal Dose Reconstruction Implementation Guideline*
  - Site-specific air monitoring data and process data available to estimate internal uranium doses
  - Airborne mass loading calculations from air monitoring data to estimate internal thorium doses
Evaluation of Petition Basis - External Monitoring

- “No external dosimetry results are available for Superior Steel employees.” (ORAUT-TKBS-0034)
  - When personal and area external monitoring data are unavailable, NIOSH uses workplace information (e.g., source term, process) to estimate dose, in accordance with NIOSH’s OCAS-IG-001, *External Dose Reconstruction Implementation Guideline*
  - Site-specific information, in conjunction with Battelle-TBD-6000, to model external uranium exposures
  - Site-specific information, in conjunction with Battelle-TBD-6000, to model external thorium exposures
Feasibility Findings for SEC-00247 Superior Steel Co. January 1, 1952 to December 31, 1957

<table>
<thead>
<tr>
<th>Source of Exposure</th>
<th>Dose Reconstruction Feasible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium Internal</td>
<td>Yes</td>
</tr>
<tr>
<td>Thorium Internal</td>
<td>Yes</td>
</tr>
<tr>
<td>Uranium External</td>
<td>Yes</td>
</tr>
<tr>
<td>Thorium External</td>
<td>Yes</td>
</tr>
<tr>
<td>Occupational Medical X-rays</td>
<td>Yes</td>
</tr>
</tbody>
</table>
NIOSH Proposed Dose Reconstruction Methods - Applicable Years

- **Uranium**
  - **Operations:**
    - June 27, 1952 through December 31, 1957
  - **Residual Contamination:**
    - January 1, 1958 through present

- **Thorium**
  - **Operations:**
    - March 27, 1956 through April 20, 1956
  - **Post-Ops Contamination:**
    - April 21, 1956 through December 31, 1957
    - *Commercial, non-AEC work*
### NIOSH Proposed Dose Reconstruction Methods - Internal Exposures (1952-1957)

<table>
<thead>
<tr>
<th>Intake Information</th>
<th>Uranium</th>
<th>Thorium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rolling</strong></td>
<td>500 h per year</td>
<td>10 h during March – April 1956</td>
</tr>
<tr>
<td>U air concentration results</td>
<td>Th air concentration calculated using a mass loading approach</td>
<td></td>
</tr>
<tr>
<td><strong>Resuspension</strong></td>
<td>2000 h per year</td>
<td>Remainder of 1956 and all of 1957</td>
</tr>
<tr>
<td>U resuspension</td>
<td>Th resuspension</td>
<td></td>
</tr>
<tr>
<td><strong>Material Assessed as</strong></td>
<td>U-234 including recycled U contaminants</td>
<td>Th-232 including Th daughter products in secular equilibrium</td>
</tr>
</tbody>
</table>
## NIOSH Proposed Dose Reconstruction Methods - External Exposures (1952-1957)

<table>
<thead>
<tr>
<th>Exposure Type</th>
<th>Uranium</th>
<th>Thorium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Rolling</strong></td>
<td>500 h per year Battelle-TBD-6000 rolling operations dose</td>
<td>10 h in March – April 1956 MCNP modeling and distance guidance in Battelle-TBD-6000</td>
</tr>
<tr>
<td><strong>Submersion Rolling</strong></td>
<td>500 h per year submersion using DCF from EPA-FGR-12</td>
<td>10 h in March – April 1956 submersion using DCF from EPA-FGR-12</td>
</tr>
<tr>
<td><strong>Direct Storage</strong></td>
<td>500 h per year Battelle-TBD-6000 1m dose rate</td>
<td>190 h in March – April 1956 MCNP modeling for dose rate at 1m</td>
</tr>
<tr>
<td><strong>Post-rolling</strong></td>
<td>2000 h per year submersion and direct exposure using DCF from EPA-FGR-12</td>
<td>Remainder of 1956 and all of 1957 submersion and direct exposure using DCF from EPA-FGR-12</td>
</tr>
</tbody>
</table>
Responses to the SC&A Review of the SEC-00247 ER
Summary of Issues, Responses, and WG Discussion

- SC&A’s June 2019 ER Review Issued:
  - 2 Findings
  - 4 Observations
- October 2019: NIOSH provided responses
- January 2020: SC&A provided responses
- February 4, 2020: TBD-6000 WG met to discuss the issues and responses
  - WG voted to close Finding 2 and all 4 Observations
  - Finding 1:
    - WG voted to close this as an SEC Issue; follow it as a TBD Issue
    - NIOSH to provide additional information in response
Finding 1: Failure to justify process similarities that support the use of the Vulcan Crucible billing rate (1 of 4)

- Internal Dose (and External Dose)
- ER proposed using Vulcan Crucible billing rate of $132 per mill-hour and Superior Steel Co. contract payment for 1957 of $54,632 to calculate exposure time, specific to rolling hours
  - 414 mill-hours → 500 hours rolling exposure

- NIOSH Response
  - Evaluated the billing rate via the 5 criteria in the NIOSH Implementation Guide “The Use of Data from Other Facilities in the Completion of Dose Reconstructions Under the Energy Employees Occupational Illness Compensation Program Act” (OCAS-IG-004)
Finding 1: Vulcan Crucible billing rate (2 of 4)

- NIOSH Response (cont.)
  - Source Term: Both rolled uranium billets
  - Facility and Process Similarities: Both similar processes and timing
  - Temporal Considerations: Vulcan billing rate from 1948
  - Data Evaluation:
    - Simonds Saw and Steel- $110.53 per rolling hour
    - Joslyn- $450 per rolling hour for different process
    - Joslyn- $88.03 per hour ($0.11 per pound) never implemented
    - Superior Steel Co.- $1.01 per pound
Finding 1: Vulcan Crucible billing rate (3 of 4)

- NIOSH Response (cont.)
  - Review of Bounding Scenario:
    - Compilation of Rolling Information in Table 7-1 yields about 60h per year rolling exposure
    - Modification #5 to the Superior Steel Co. contract yields about 510h for the entire contract
      - additional assumptions of (1) weight of slabs and (2) # of slabs rolled per day or year
    - NIOSH stands by the use of the Vulcan Crucible billing rate to determine the number of rolling hours
Finding 1: Vulcan Crucible billing rate (4 of 4)

- **SC&A Response**
  - Agree with NIOSH that annual milling hours can be bounded
  - Approach to calculate milling hours should use the billing rate $1.01 per pound uranium from Modification #5 to the Superior Steel Co. contract given Board’s hierarchy of data criterion
  - Estimates bounding 253 hours per year

- **TBD-6000 WG**
  - Requested additional information on the data inputs in order to assess the uncertainty in the final calculation of annual rolling hours
    - Action Item is with NIOSH
Finding 1: Vulcan Crucible billing rate (cont.)

- **NIOSH Response (March 2020)**
  - Explored the rolling time distribution using a statistical simulation and available slab weight and rolling throughput data
  - Proposes using the 95\textsuperscript{th} percentile of this simulated distribution of the rolling time = \textbf{267 uranium rolling hours per year}
  - Not much higher than the SC&A proposed estimate of 253 hours, but incorporates all of the available Superior Steel Co. data
Finding 2: 1955 survey distributions may not bound air concentrations

- Internal Dose
- Intake Rate based on results of the 4 HASL air sampling campaigns
  - ER proposed 2 intake rates: 1953 data and 1955 data
- NIOSH Response
  - Remove May 1955 data and use the other 3 datasets to determine the intake rate for the entire exposure period
- SC&A Response
  - Recommends the Board accept the modified approach
- TBD-6000 WG
  - Agreed to remove the May 1955 data from dataset; Voted to Close
Observation 1: New approach to bounding source term based on contract billing in combination with another site’s billing rate

- Internal Dose and External Dose
- ER proposed use of Vulcan Crucible billing rate to calculate number of uranium rolling hours (Exposure Time, specific to rolling hours)
- NIOSH Response
  - Clarified the billing rate isn’t used for source term assumptions
  - Source term is U slabs based on the AEC contract & process info
- TBD-6000 WG
  - Voted to Close
Observation 2: One-to-one Thorium-to-Uranium ratio for calculation of Thorium air concentration inconsistent with precedent of 10% used in past ERs

- Internal Dose
- ER proposed Thorium intake rate based on uranium air sample mass loading
- NIOSH Response
  - Bridgeport Brass
    - Thorium intake rates equal 10% of the Uranium intake rates
    - Uranium and Thorium rolled concurrently
    - Air sampling results include contributions from both Uranium and Thorium
  - Superior Steel air sampling only performed during Uranium work
Observation 2: Thorium-to-Uranium ratio (cont.)

- **SC&A Response**
  - After review of NIOSH response, understands that the assumption for Bridgeport Brass is not applicable to Superior Steel
  - Recommends Closing

- **TBD-6000 WG**
  - Voted to Close
Observation 3: Uranium storage time assumption is inadequate to capture length of time material was likely on-site

- **External Dose**
- **ER proposed 500 hours per year of exposure from material storage**
- **NIOSH Response**
  - Given petitioners’ comments and review of applicable reference documents, change to year-round minus rolling time for the entire operational period
- **SC&A Response**
  - Recommends the Board accept the modified approach
- **TBD-6000 WG**
  - Voted to Close
Observation 4: Annual medical examination assumption in spite of evidence may be inconsistent

- Occupational Medical Dose
- ER proposed continuing assignment of pre-employment, annual, and termination PA chest X-ray doses
- NIOSH Response
  - Default assumptions from ORAUT-OTIB-0006 and ORAUT-OTIB-0079 when evidence is lacking
- SC&A Response
  - Sampled 10 AWE claims reviews from DR Subcommittee and found they followed this guidance
- TBD-6000 WG
  - Voted to Close