SEC-00247
Superior Steel Co.

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Health Physicist

Advisory Board on Radiation and Worker Health, 126th Meeting
Redondo Beach, CA
December 12-13, 2018
About Superior Steel Co. Site

- Carnegie, PA
  - 5 inter-connected 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
Section 00247 Petition for Superior Steel Co.

- 83.13 (Form B) Petition Received May 1, 2018
  - Petitioner-requested class: All workers who worked in any area at the Superior Steel Co. facility in Carnegie, PA during the period from January 1, 1952 through December 31, 1957.
  - (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 on July 19, 2018
  - Qualified class: 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.
## Number of Superior Steel Co. Claims

*(as of October 2, 2018)*

<table>
<thead>
<tr>
<th>Description</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of claims submitted for dose reconstruction</td>
<td>35</td>
</tr>
<tr>
<td>Total number of claims submitted for energy employees who worked during the period under evaluation (January 1, 1952 through December 31, 1957)</td>
<td>35</td>
</tr>
<tr>
<td>Number of dose reconstructions completed for energy employees who worked during the period under evaluation</td>
<td>35</td>
</tr>
<tr>
<td>Number of claims for which internal dosimetry records were obtained for the time period under evaluation</td>
<td>0</td>
</tr>
<tr>
<td>Number of claims for which internal dosimetry records were obtained for the time period under evaluation</td>
<td>0</td>
</tr>
</tbody>
</table>
Superior Steel Co. Exposure Time

- AEC contract [AT(30-1)-1412] effective date is June 27, 1952
- AEC contract end date is September 30, 1957
  - Evidence that the fission material accounting station authority was withdrawn on November 27, 1957
- AEC cost-plus-fixed-fee contract was for intermittent, on-demand rolling
- Payments to Superior Steel Co. through fiscal year 1957 totaled $356,849
- CATI information tells us overtime work was common
Radiological Sources at Superior Steel Co.

- Majority of AEC rolling campaigns were with natural uranium metal
- 1 AEC rolling campaign included 6 slabs of 1.5% enriched uranium metal
- *Since the Superior Steel Co. operations were after 1952, uranium metal could be recycled*

- 1 commercial, small-scale rolling campaign with 700 pounds of thorium metal
AEC Licensing for Thorium at Superior Steel Co.

- March 27, 1956: AEC license “to receive, possess, use, and transfer” 700 pounds of thorium metal from Babcock and Wilcox (B&W) to perform studies similar to work done for AEC.

- April 20, 1956 and April 23, 1956: Superior Steel Co. request for license amendment for unlimited quantities of thorium metal owned by Consolidated Edison to be used by B&W in critical experiments; mentions data from test rollings.

Thorium Rolling at Superior Steel Co.

- No evidence of shipping, receiving, or rolling of thorium in document reviews
- 5 radiological surveys done in support of more recent clean-up efforts
  - Gamma spectroscopy of soil and other samples taken from inside buildings
    - Uranium contamination found, as expected
    - No evidence of thorium contamination
  - Gamma scan survey of land surrounding facility
    - Uranium contamination found in spatial distribution around buildings
    - Background levels and spatial distribution typical of naturally-occurring thorium

- *NIOSH concludes no large-scale use of thorium at Superior Steel Co.*
Internal Exposure Routes at Superior Steel Co.

- Inhalation and ingestion of uranium and thorium metal and oxidized material via:
  - Dispersion during rolling and related processes
  - Dust-settling of contamination
  - Resuspension of contamination
External Exposure Scenarios at Superior Steel Co.

- Photon and beta radiation from uranium and thorium metal ingots and slabs via:
  - Direct exposure
  - Exposure from the contaminated surfaces within the facility
  - Submersion in contaminated air within the facility
- Occupational Medical X-rays
Monitoring Data Available-
Internal Exposure at Superior Steel Co.

- **Personal Monitoring:** No in vitro or in vivo results and there is no indication of internal dosimetry monitoring program.

- **Area Monitoring:** Four campaigns of air monitoring (e.g., BZ and area) performed by AEC Health and Safety Laboratory (HASL) during uranium rolling:
  - May 13, 1953
  - August 3, 1953
  - May 9, 1955
  - September 19, 1955
# Summary of Breathing Zone Air Monitoring Data - Uranium Rollings

<table>
<thead>
<tr>
<th>Date</th>
<th># of Samples</th>
<th>Highest Alpha Recorded (\frac{dpm}{m^3})</th>
<th>Location of Highest Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 9, 1955</td>
<td>9</td>
<td>38,500</td>
<td>Stamping Plate (manual operation)</td>
<td>AEC, 1955a</td>
</tr>
<tr>
<td>September 19, 1955</td>
<td>6</td>
<td>18,000</td>
<td>Stamping 3 sections of plate</td>
<td>AEC, 1955b</td>
</tr>
</tbody>
</table>
## Summary of Area Air Monitoring Data-Uranium Rollings

<table>
<thead>
<tr>
<th>Date</th>
<th># of Samples</th>
<th>Highest Alpha Recorded ($dpm/m^3$)</th>
<th>Location of Highest Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 13, 1953</td>
<td>28</td>
<td>13,200</td>
<td>A</td>
<td>Klevin, 1953a</td>
</tr>
<tr>
<td>August 3, 1953</td>
<td>33</td>
<td>49,110</td>
<td>B</td>
<td>Klevin, 1953b</td>
</tr>
<tr>
<td>May 9, 1955</td>
<td>61</td>
<td>1,800</td>
<td>C</td>
<td>AEC, 1955a</td>
</tr>
<tr>
<td>September 19, 1955</td>
<td>38</td>
<td>3,320</td>
<td>D</td>
<td>AEC, 1955b</td>
</tr>
</tbody>
</table>

From Myrick, 1981
Monitoring Data and Information Available - External Exposure at Superior Steel Co.

- **Personal Monitoring**: No external dosimetry results and there is no indication of external dosimetry monitoring program.
- **Area Monitoring**: No indication of area external dose monitoring program.

- Information is available to NIOSH about the Superior Steel Co.’s AEC contract, radiological material licensing, processes, and the material processed.
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>Rolling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 h per year U air concentration results</td>
<td>10 h during March – April 1956 Th air concentration calculated using a mass loading approach</td>
</tr>
<tr>
<td>Resuspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000 h per year U resuspension</td>
<td>Remainder of 1956 and all of 1957 Th resuspension</td>
</tr>
<tr>
<td>Material Assessed as</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U-234 including recycled U contaminants</td>
<td>Th-232 including Th daughter products in secular equilibrium</td>
</tr>
<tr>
<td>Exposure Type</td>
<td>Uranium</td>
<td>Thorium</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Direct Rolling</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>Submersion Rolling</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>Direct Storage</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>Post-rolling</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>
Dose Reconstruction Feasibility Conclusion

- NIOSH has sufficient air data and process information to bound internal and external dose from AEC uranium metal rolling operations.
- NIOSH has sufficient process information to bound internal and external dose from the small-scale, commercial thorium metal rolling operation.
- The NIOSH Site Profile for Superior Steel Co. (effective date 2005) will be updated with the additional information captured and reviewed in this evaluation.
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*.
  – Sufficient site-specific air monitoring data and process data to calculate estimates of worker internal uranium doses with sufficient accuracy
  – Airborne mass loading calculations using available uranium process air monitoring data to estimate worker 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*.
  - Sufficient applicable site-specific information, using the methods of Battelle-TBD-6000, to model potential external uranium exposures
  - Model thorium metal related exposures in accordance with the methods presented in Battelle-TBD-6000 using MCNP
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>
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</thead>
<tbody>
<tr>
<td><strong>Internal</strong></td>
<td></td>
</tr>
<tr>
<td>Uranium</td>
<td>Yes</td>
</tr>
<tr>
<td>Thorium</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td></td>
</tr>
<tr>
<td>Uranium</td>
<td>Yes</td>
</tr>
<tr>
<td>Thorium</td>
<td>Yes</td>
</tr>
<tr>
<td>Occupational Medical X-rays</td>
<td>Yes</td>
</tr>
</tbody>
</table>
References

- Klevin, 1953a, *Superior Steel Company Air Dust Monitoring of Hot Strip Rolling of Uranium*; Paul B. Klevin, Industrial Hygiene Branch Health and Safety Division; issued May 22, 1953; SRDB Ref ID: 6898
- Klevin, 1953b, *Superior Steel Company Air Dust Monitoring of Hot Strip Rolling of Uranium*; Paul B. Klevin, Industrial Hygiene Branch Health and Safety Division; issued September 8, 1953; SRDB Ref ID: 6899, PDF pp. 2-12
References- continued

- USACE, 2018, *Superior Steel Site Fact Sheet (January 2018)*, U.S. Army Corps of Engineers- Buffalo District, Environmental Project Management Team; January 2018; SRDB Ref ID: 173724