Update for the Advisory Board on Radiation and Worker Health Y-12 Work Group

Lara Hughes, PhD, CHP
Health Physicist

Teleconference of the Y-12 Work Group
September 24, 2020
Overview

- Y-12 Background
- Y-12 SEC Petition History
- SEC-00250 Petition Evaluation
- SEC-00250 Evaluation Report Addendum
- Co-Exposure Effort
- Y-12 Issues Matrix
- Post ER Petitioner Submission
- Questions and Discussion
Y-12 Background
Y-12 Background

- 811-acre site
- 0.67 by 3.2 miles
- Peak employment: 22,000 workers, down to ~5700 by 1998
- Covered period: 1942 – present
Y-12 Site History

- First Era (until 1946) – Uranium (U) isotope separation
  - Calutrons for U enrichment

- Second Era (until ~ 1994) – Cold War nuclear weapons components manufacturing
  - Produce and test key components of nuclear weapons
    - Stockpiling High-Enriched Uranium (HEU)
    - Technology development for new weapons designs

- Third Era (after ~ 1994) – Multiple new missions
  - Storing HEU
  - Continued weapons part production on smaller scale
  - Environmental and waste management
Y-12 Site History – Thorium

- Thorium (Th) production began in 1959
- Arc-melting, forging, machining and other related metal processes to produce metal parts for nuclear weapons
- Consumable electrode arc melting: Radium volatilizes
- Main production period: 1961 – mid-1970s, metric ton quantities
- Parts refurbishment until 1989
- 1994: plant in stand down mode, special project Th work only
Y-12 Petition History
# Y-12 Petition History

<table>
<thead>
<tr>
<th>Petition</th>
<th>Status</th>
<th>Basis</th>
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<tbody>
<tr>
<td>SEC-00250</td>
<td>Under evaluation</td>
<td>Reserved Period from 1987-1994 due to need to collect and evaluate Th data from Y-12</td>
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<tr>
<td>SEC-00250</td>
<td>Class added to SEC for 1958 - 1976</td>
<td>Infeasibility to reconstruct doses from Th, and Plutonium-241</td>
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<tr>
<td>SEC-00251</td>
<td>Class added to SEC for 1948 - 1957</td>
<td>Infeasibility to reconstruct doses from Th and cyclotron radionuclides</td>
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<tr>
<td>SEC-00098</td>
<td>Class added to SEC for 1943 - 1947</td>
<td>Infeasibility to reconstruct internal doses from calutron operations</td>
</tr>
<tr>
<td>SEC-00028</td>
<td>1948-1957</td>
<td>Initial limited class</td>
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<tr>
<td>SEC-00018</td>
<td>1943-1947</td>
<td>Initial limited class</td>
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Y-12 SEC-00250 Petition Evaluation
SEC-00250 Petition Evaluation

- Evaluation Report presented in August 2019
- Class recommended to be added to SEC: 1/1/1977 – 7/13/1979
- Class effective: November 24, 2019
- Dose Reconstruction feasible: 8/1/79 – 12/31/86
  - Reserved because of data accessibility issues at Y-12
- NIOSH issued a response to SC&A Review on: 06/03/2020
Petition qualified based on basis F.4 for issues related to in-vivo Th data from evaluation of SEC-00251 (83.14 petition)

Evaluated the feasibility of reconstructing internal doses from Th

Three different periods identified:

- 1977 – 1979: Th internal data only in mg results, no calibration data available, thus Th DR infeasible ➔ SEC class recommended
- 1979 – 1986: Th in-vivo data have Pb-212 and Ac-228 results and can be used to bound internal Th doses ➔ DR feasible
- 1987 – 1994: Th data are available but have to be collected from Y-12 and evaluated ➔ Reserved period
SEC-00250 Evaluation Report Review by SC&A

- Issued in February 2020
- 4 Findings, 12 Observations
- Main discussion points:
  - The scope of work
  - The in-vivo data and potential use for co-exposure model
  - Job categories
  - U data used in existing co-exposure model
  - Machinist exposures at Y-12
  - Exotic Radionuclides, Pu-241, RPRT-0090 issues
NIOSH Response to SC&A Review of SEC-00250

- NIOSH issued response to SC&A review of SEC-00250 in June 2020:
  - Th co-exposure model will be based on new guidelines
  - Data completeness evaluation of Th in-vivo data will be based on new guidelines
  - New information on Th inventory data was collected in late 2019
  - Revisions of existing co-exposure models will follow new guidelines
  - Pu-241 monitoring ability is addressed in SEC-00251 ER
  - RPRT-0090 issues are addressed under ORNL effort
Y-12 SEC-00250 Addendum
SEC-00250 Addendum

- Additional data requests to Y-12 for in-vivo Th data
- Several calls to clarify and corroborate information on Th data
- Assessing different issues with available data (lack of Pb-212 channel data in records from 1992 – 1994)
- Current Status: to be finalized after receiving final data clarification from Y-12
Co-Exposure Model Revisions
Y-12 Co-Exposure Model Development

- Current effort is revision of external co-exposure model using current methods
- Addresses the need to update OTIB-0044, OTIB-0045, OTIB-0046, OTIB-0064
- Specifically:
  - Assess validity of Y-12 data set using RPRT-0086 methods
  - Perform analysis of Y-12 data set using RPRT-0071 guidance
  - Completely revise OTIB-0064, Y-12 external coworker model
Y-12 Co-Exposure Model Development – cont’d

- Database evaluation
- Statistical analysis instructions are being developed
- Questions for Y-12 dosimetry staff to clarify some issues with the data sets to ensure correct interpretation of the data
  - Example issues:
    - Exchange frequency
    - Wear time gaps
    - Wear time overlaps
- Response from Y-12 expected mid-September 2020
Y-12 Issues Matrix
Y-12 Issues Matrix from 2005

- SC&A Review of Y-12 Documents (TBDs TIBs) from ~ 2005
- NIOSH issues resolution effort in 2008
- Former Y-12 WG retired, effort was put on hold
- Documents have been revised
- Several SEC classes implemented
- New Co-exposure models are underway
- NIOSH to re-assess what issues remain and resolve
Post ER Petitioner Submissions
SEC-00250 – Y-12 Former Worker Interview

- Petitioners contacted NIOSH with knowledge of former worker involved with in-vivo counting at Y-12
- Interview with petitioner and individual who worked on in-vivo counter
  - Hand contamination from machining
  - Employees were surveyed before in-vivo count
  - Survey meter use was done incorrectly (suggested bias towards detecting surface contamination when none was present)
  - Contaminated workers were deferred from in-vivo count
  - Workers were also restricted from work if found contaminated
  - Contention that this reduced the frequency of high in-vivo counts
SEC-00250 – Additional Petitioner Submission

- Received August 15, 2020, available to WG and SC&A in DSA
  - Compliance Issues
  - Data base quality issues (CER and hardcopy records)
  - Some issues from previous SC&A Review of Y-12 TBD in 2005
  - Availability of worker records for DR
  - Machinists not wearing gloves and long sleeves (entrapment hazard)
- No information that would indicate an infeasibility for reserved period
### Petitioner Documentation

<table>
<thead>
<tr>
<th>Issue</th>
<th>NIOSH preliminary assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CER dose records veracity and applicability</td>
<td>CER data has undergone QC and has been found suitable for use, NIOSH uses bioassay data, not the reported dose data for modeling</td>
</tr>
<tr>
<td>Pb-212 background levels too high</td>
<td>Unclear attribution for this statement. Pb-212 lung count methodology is available for DR from mid-1979 on</td>
</tr>
<tr>
<td>Th lung counting discontinued in 1984</td>
<td>Lung count data is available past 1984, data is for Ac-228 and Pb-212 which are used to infer Th lung burden</td>
</tr>
<tr>
<td>Insoluble internal dose monitoring not done until 1989</td>
<td>Bioassay suitable for DR at Y-12 is available prior to 1989, including fecal sampling</td>
</tr>
<tr>
<td>Bioassay for some workers more frequent (salaried vs. hourly)</td>
<td>DR methods have been developed and no bias toward salaried workers has been observed.</td>
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### Petitioner Documentation – cont’d

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<tr>
<td>Machinists required to work without arm/hand coverings</td>
<td>NIOSH has reviewed this issue and found it can be addressed for DR at Y-12</td>
</tr>
<tr>
<td>Some machinists were not monitored</td>
<td>Unmonitored dose can be assigned using co-exposure dose</td>
</tr>
<tr>
<td>Supervisors determined who needed respirators</td>
<td>The primary data used for DR takes into account any reduction in exposure afforded by respiratory protection</td>
</tr>
<tr>
<td>Uncertainties in bioassay data need to be addressed (Super S, 48 hr sampling)</td>
<td>Methodology for Super S Pu has been developed, some other issues related to bioassay data still need to be addressed</td>
</tr>
<tr>
<td>Air monitoring insufficient to estimate internal doses</td>
<td>ORAUT-TKBS-0014-4 provides an alternate methodology to arrive at a more claimant favorable estimation of environmental internal dose</td>
</tr>
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</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Tiger team findings on air monitoring</td>
<td>These findings do not affect DR feasibility for Y-12</td>
</tr>
<tr>
<td>Other radionuclides not monitored</td>
<td>ORAUT-TKBS-0014-5 contains guidance on the interpretation and assessment of exposure from the listed nuclides, some additional assessment may be needed</td>
</tr>
<tr>
<td>10CFR requirement on PNADs</td>
<td>This does not impact the feasibility of NIOSH to complete DR for Y-12 claims</td>
</tr>
<tr>
<td>DOE regulation issues (eating, smoking in work areas…)</td>
<td>This does not impact the feasibility of NIOSH to complete DR for Y-12 claims</td>
</tr>
<tr>
<td>Worker dosimetry data is not available or incorrect</td>
<td>Worker dosimetry data at Y-12 has been reviewed and found suitable for DR approaches and co-exposure models</td>
</tr>
<tr>
<td>Workers have trouble accessing their own records, assumes NIOSH has the same issue</td>
<td>NIOSH does receive worker records from Y-12</td>
</tr>
</tbody>
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Questions and Discussion