# Y-12 SEC-00250 Petition Evaluation Report Addendum

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# Y-12 SEC History

| Petition | Status | Basis of Class added to SEC |
|---|---|---|
| **SEC-00250 Addendum** | Reserved period (1987-1994) | None recommended |
| **SEC-00250** | Class added to SEC for 1977-07/1979 (No class rec. for 8/1979-1986) | Infeasibility to reconstruct doses from Thorium (Th), period from 1987-1994 reserved |
| **SEC-00251** | Class added to SEC for 1958 - 1976 | Infeasibility to reconstruct doses from Thorium (Th), and plutonium-241 |
| **SEC-00186** | Class added to SEC for 1948 - 1957 | Infeasibility to reconstruct doses from Th and cyclotron radionuclides |
| **SEC-00098** | Class added to SEC for 1943 - 1947 | Infeasibility to reconstruct internal doses from calutron operations |
| **SEC-00028** | 1948-1957 | Initial limited class |
| **SEC-00018** | 1943-1947 | Initial limited class |

# Y-12 SEC-00250 Petition Evaluation

- Received November 1, 2018 with proposed class:
  - All workers who worked in any area of Y-12 where Uranium (U) was fabricated or processed from January 1, 1980 to December 31, 2000
- NIOSH-evaluated class:
  - All employees who worked at the Y-12 Plant in Oak Ridge, TN that may have incurred Th exposures during the period January 1, 1977 through December 31, 1994
  - Y-12 plant was placed in stand down mode in Sep. 1994 – end of routine processing operations, thus NIOSH ended the qualified period then

# Y-12 SEC-00250 Petition Evaluation History (cont.)

- Period not recommended to be added to the SEC:
  - August 1, 1979 through December 31, 1986:  Th doses can be reconstructed with available data

- **SEC-00250 ER Addendum:**
  - **January 1, 1987 through December 31, 1994: Th doses can be reconstructed with available data**

# Y-12 Claim Numbers (as of January 2021)

| | |
|---|---|
| **6,869** | Total number of claims submitted for dose reconstruction (DR) |
| **2,763** | Workers who worked from January 1, 1987 through December 31, 1994 |
| **806** | Workers who started employment during the evaluation period |
| **2,616** | DRs completed during the reserved evaluation period |
| **1,341** | With internal dosimetry records for evaluation period |
| **2,363** | With external dosimetry records for evaluation period |

# Sources of Available Information

- Data collected from Y-12
- DOE operations center Germantown
- Site Profile and Technical Information Bulletins and Procedures
- NIOSH Site Research Database (SRDB): >10,000 documents related to Y-12
- Coworker studies
- Electronic databases
- 23 Interviews with former Y-12 employees
- Scientific publications
- Existing claimant files

# Y-12 History

- 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) – 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 HEU
    - Technology development for new weapons designs
- **Third Era (after ~ 1994) – Multiple new missions**
  - Storing HEU
  - Environmental and waste management
  - Continued weapons part production on smaller scale

# Y-12 History – Th Parts Production

- Production of Th metal parts using arc melting started in 1959
- Th pellets pressed into electrodes and arc-melted into ingots
- Ingots from meltings pressed, rolled and machined, scrap recycled
- Radium and other Th progeny volatilized during arc melting
- Major Th processing ended in mid-1970s, all Th arc melting ended in 1994

# Y-12 History – Th Parts Production (cont.)

- Th parts refurbishment and small-scale special projects continued until 1999
- Entire Y-12 Plant was in stand-down in 1994 through 1998
- All special projects ended in 1999 after a DU incident with the arc melter
- Process Buildings: 9202, 9766, 9215, 9201-5, 9204-4, 9201-1, 9206
- Storage Buildings: 9202, 9995

# Y-12 History – Th Inventory

| Year | Th inventory (kg) |
|---|---|
| 1986 | 5437 |
| 1987 | 4101 |
| 1988 | 4171 |
| 1989 | 4185 |
| 1990 | 4180 |
| 1991 | 4166 |
| 1992 | 4888 |
| 1993 | 4885 |
| 1994 | 5499 |
| 1995 | 18,066 |

- Inventory relatively consistent over evaluation period (1987-1994)
- Increase in 1995 is due to “weapons awaiting disassembly” i.e. storage operations

# Th Exposure Potential

- Th is the beginning of a decay series which contains multiple radionuclides
- Number of separations of the Th affects total dose potential
- Nuclides of particular dosimetric concern: Th-232, Th-228, Ra-228
- Arc melting is the Th process of most concern due to airborne contamination generation and disruption of the Th decay chain
- Radium contained in the metal is vaporized and released into the air
- Ingot from arc melting  has radium enriched outer layer

# Internal Th Dose Data Availability

- Th lung counts exist for 1959-1994
- Th results available in units of mass (mg) for 1959 – July 31, 1979
- Th results containing progeny activity  available from 8/1979 – 1994
- NIOSH has obtained useable Th in vivo count data for 1987-1994 from 3 systems:
  - NaI detector at Y-12 in vivo facility (1/2/1987-12/10/1991)
  - LEGe detector at K-25 (1/13/1992 – 1/6/1994)
  - LEGe detector at Y-12 (5/14/1992 – 12/29/1994)

# Y-12 Th Records 1979-1986 (SEC-00250 ER)

| Year | Number Individuals | Number of Ac/Pb Measurements |
|---|---|---|
| 1979 | 43 | 55 |
| 1980 | 110 | 128 |
| 1981 | 142 | 208 |
| 1982 | 83 | 179 |
| 1983 | 130 | 166 |
| 1984 | 87 | 89 |
| 1985 | 83 | 84 |
| 1986 | 95 | 98 |
| **Total** | **512** | **1,007** |

# Y-12 Th Records 1987-1994 (SEC-00250 Addendum)

| Year | Y-12 NaI Lung Counts | K-25 LEGe Lung Counts | Y-12 LEGe Lung Counts |
|---|---|---|---|
| 1987 | 240 | | |
| 1988 | 547 | | |
| 1989 | 665 | | |
| 1990 | 825 | | |
| 1991 | 1182 | | |
| 1992 | | 174 | 460 |
| 1993 | | 4 | 886 |
| 1994 | | | 850 |
| **Total** | **3459** | **198** | **2196** |

# Data Pedigree

- Standard process of SEC evaluations
- Data stored in two separate data repositories for evaluation period (1987-1994)
  - Delta View Imaging System, scans of “raw” data reports
  - Electronic Record System (ERS), tabulated records summary
- Some discrepancies were found when comparing the two sources
  - Delta View but not in ERS: 838 records
  - Mostly from 7000 and 9000 series departments
- Clarification requested from Y-12

# Data Pedigree (cont.)

- Y-12 provided updated ERS file, based on updated search criteria
  - 568 were provided by Y-12 in the update file
  - 132 declared invalid measurements
  - 128 not in ERS because of a data migration error (Delta View is copy of record)
- Pedigree issues were satisfactorily resolved
- Data are of sufficient quality to be used in bounding Th dose

# General Approach for Th Dose Reconstruction

- Th doses can be bounded using the gamma spectral data from the *in vivo* count for Ac-228 and Pb-212, nuclides in the Th decay chain
- NIOSH developed OTIB-0076, Guiding Reconstruction of Intakes of Th Resulting from Nuclear Weapons Programs to assign Th doses
- Pb-212 results are used to estimate intakes of Th-232 and Th-228
- Ac-228 results are used to estimate intakes of Ra-228
- Intakes are used to assign internal doses from Th

# Specifics for Th Dose Reconstruction for Y-12

- Th results from Y 12 NaI *in vivo* facility (1987-1991): doses can be bounded using established procedures

- Th results from K-25 facility (Jan-May 1992) cannot be used (no Ac-228 or Pb-212 reported)

- Th results from Y-12 LEGe *in vivo* facility (June 1992-Dec.1994): Ac-228 results only: doses can be bounded using available chest wall thickness (CWT) data as outlined in DCAS-RPRT-008

# DCAS RPRT-008

- Lung counts from June 1992- Dec. 1994 records only have Ac-228 measurement, but no Pb-212 measurement
- In-vivo spectral data was used to estimate the Pb-212 detection efficiency and background in the Pb-212 energy region
- A function was developed to derive the Pb-212 MDA using the chest wall thickness measurement (CWT)
- MDA can be used as an upper bound in lieu of critical level
- Applied as a triangular distribution

# Internal Dose Bounding Summary

- Available monitoring records are sufficient to complete internal Thorium dose reconstruction for the proposed class of employees from January 1, 1987 through December 31, 1994
  - 1/1/1987 – 12/31/1991: using available Ac-228 and Pb-212 data to bound the dose using methods described in OTIB-0076
  - 6/1/1992 – 12/31/1994: using available Ac-228 data and CWT information outlined in DCAS-RPRT-008
  - Data from K-25 in vivo counter 5/1992-12/1994 is not used

# Feasibility Findings for Y-12 (SEC00250)

| Source of Exposure | Dose Reconstruction Feasible |
|---|---|
| **Internal - Th** | Yes |

# Questions/Discussion