



Y-12 SEC-00250 Petition Evaluation Report

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Y-12 SEC History

Petition	Status	Basis
SEC-00250	Current petition	Pending Board Action
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
- Reserved period:
 - January 1, 1987 through December 31, 1994: awaiting release of Th data from Y-12

Proposed Class Definition (Initial)

- All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Y-12 Plant in Oak Ridge, Tennessee, during the period January 1, 1977 through July 31, 1979 for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort.

Y-12 Claim Numbers (as of May 2019)

6,525 Total number of claims submitted for dose reconstruction (DR)

3,615 Workers who worked from January 1, 1977 - December 31, 1994

1,825 Workers who started employment during the evaluated period

3,211 DRs completed for the evaluated period

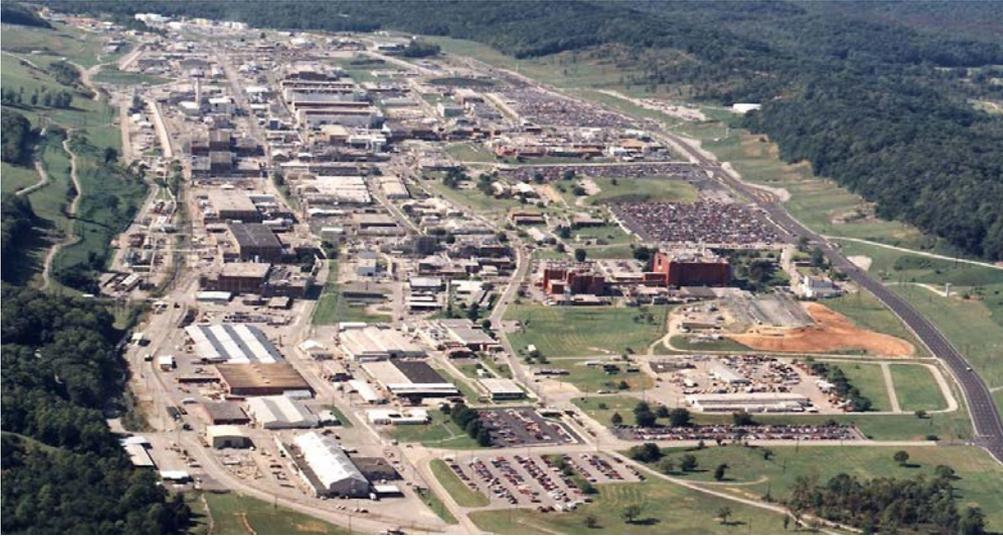
1,688 With internal dosimetry records for evaluation period

3,267 With external dosimetry records for evaluation period

Sources of Available Information

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

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

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 depleted U (DU) incident with the arc melter
- Process Buildings: 9202, 9766, 9215, 9201-5, 9204-4, 9201-1
- Storage Buildings: 9202, 9995

Y-12 History – U Processes

- U processed to produce weapons components using a variety of compounds and enrichments
- Larger scale process compared to Th operations
- U enrichment production started in 1943

Y-12 History – U Processes (cont.)

- U operations shifted to recovery and recycling mostly normal and depleted U after WW II
- U production processes also included arc melting
- Machined components sent through finishing operations that included drilling, welding, brazing, polishing, and final specification checks

Y-12 History – Isotopes Production Group

- ORNL Isotopes Group used Y-12 (and ORNL) facilities for isotope production, separation and purification
- Y-12 facility, but main operations staffed by ORNL workers
- Production of radioactive and stable materials
- Addressed in a previous NIOSH report (RPRT-0090) to address exotics at ORNL

Y-12 History – Isotopes Production Group (cont.)

- Calutrons in Building 9204-3: U and Plutonium (Pu) production
- 86-inch cyclotron (9201-2): medical isotope production, operated 1950-1983
- Conversion Lab: Radiochemistry facility that handled the radioisotopes from the calutron and cyclotron operations

U and Other Isotopes Exposure Potential

- Inhalation of airborne particulate radioisotopes was the main concern for internal exposure to U and other isotopes
- U was the principal source of internal exposure at Y-12 due to the large scale of the operations
- Trace quantities of Pu, Np and Tc from recycled U

U and Other Isotopes Exposure Potential (cont.)

- Radionuclides handled by the ORNL Isotopes group at Y-12 and ORNL included 213 different isotopes
- Materials are detailed in ORAUT-RPRT-0090, which is currently being reviewed and discussed under the NIOSH ORNL effort
- Available data for U and other isotopes are sufficient to bound doses to these nuclides

Th Exposure Potential

- Th is part of a decay chain
- Number of separations of the Th affects dose
- Nuclides of particular dosimetric concern: Th-232, Th-228, Ra-228 (Radium)
- Arc melting is the Th process of most concern due to the significant release potential of airborne contamination

Th Exposure Potential (cont.)

- Arc melting process disrupts the Th decay chain
- Large quantities of the radium contained in the metal is vaporized and released into the air
- Ingot from arc melting has radium enriched outer layer
- Ra-224 and its sub-series quickly return to equilibrium

Internal Th Dose Data Availability

- Th lung counts exist for 1977-1994
- Change in recording procedure in August 1979
- Th results are reported in units of mg for 1977 – July 31, 1979
- NIOSH has received useable Th lung count data for 1979-1986
- Post-1987 available according to Y-12, but there are accessibility issues

Internal Th Dose Data Availability (cont.)

- From Y-12 in-vivo facility using NaI or Ge detector system
- Th results can be associated with Ac-228 (Actinium) and Pb-212 (Lead) measurements recorded for August, 1979 – December 31, 1986 lung counting
- Th chain disequilibrium is an issue
- No measurement data for Ra-228

Y-12 Th Records 1979-1986

Year	Number Individuals	Number of Ac/Pb Measurements
1979	46	55
1980	137	128
1981	146	208
1982	84	179
1983	130	166
1984	87	89
1985	83	84
1986	95	98
Total	808	1,007

Approach for Th Dose Reconstruction

- Th doses can be bounded using OTIB-0076, Guiding Reconstruction of Intakes of Th Resulting from Nuclear Weapons Programs:
- Th results have to be associated with in-vivo Ac-228 and Pb-212 measurements recorded for August, 1979 – December 31, 1986
- The separation history of the material has to be known or assumed (triple separated will be used for Y-12 Th approach)

Approach for Th Dose Reconstruction (cont'd)

- 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 estimate doses to organs

Internal Dose Bounding Summary

- Th internal dose reconstruction infeasibility January 1977 – July 1979 (SEC class recommendation)
- August 1979 – December 1986: analysis of Th worker Ac/Pb data can be used to bound exposure to all Th workers
- January 1987 – Dec. 1994: Evaluation Report section reserved – data expected to be obtained from Y-12, needs to be evaluated for suitability to be used in Th dose reconstruction
- Internal doses to U and exotic isotopes can be bounded using available methods discussed in Technical Basis Document and Report 90

External Dose Data

- A dosimetry (film)/security badge was adopted for use at all Y-12 facilities in the pre-SEC-00250 time period.
- Issued to all personnel at Y-12 Plant because it was part of the security badge
- Badges provided routine and accident-related monitoring
- In 1980, the film badges were replaced by Thermoluminescent Dosimeters (TLD)
- OTIB-0064 contains coworker data from 1952 – 1979
- External doses assigned based on available data and methods

Feasibility Findings for Y-12 (SEC00250)

Source of Exposure	Dose Reconstruction Feasible
Internal - Th	No (1/1/77 – 7/31/79) Yes (8/1/79-12/31/86) Reserved (1/1/1987 – 12/31/1994)
Internal - U	Yes (1/1/1977 – 12/31/1994)
Internal – Exotics	Yes (1/1/1977 – 12/31/1994)
External – Beta-Gamma	Yes (1/1/1977 – 12/31/1994)
External – Neutron	Yes (1/1/1977 – 12/31/1994)
External – Occup. Medical X-ray	Yes (1/1/1977 – 12/31/1994)

Class definition recommended

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