



# Y-12 SEC-00251 Petition Evaluation Report on Thorium and Pu-241

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# Y-12 SEC History

- SEC-00251: NIOSH dose reconstruction not feasible for existing claim
  - Claimant identified in October 2018
  - Petition received: November 9, 2018
  - Evaluation report completed November 26, 2018
- SEC-00186: class added to SEC for 1948 to 1957 based on infeasibility to reconstruct doses from thorium and cyclotron radionuclides
- SEC-00098: class added to SEC for 1943 to 1947 based on infeasibility to reconstruct internal doses from calutron operations
- SEC-00028: initial more restricted class for 1948-1957
- SEC-0018: initial more restricted class for 1943-1947

# Y-12 History



- 811 acre site
- 0.67 miles X 3.2 miles
- Peak employment: 22000 workers
- EEOICPA Covered: 1942 - present

**Aerial Photograph of Y-12 Campus, undated**

# Y-12 History

- First Era (1942-1946): U isotope separation
  - Calutrons for Uranium enrichment
- Second Era (1947-1992): Cold war nuclear weapons components manufacturing
  - Produce and test key components of nuclear weapons
  - Stockpiling HEU
  - Technology development for new weapons designs
- Third Era (post 1992): Multiple new missions
  - Storing HEU
  - Continued weapons part production on smaller scale
  - D&D
  - Environmental and waste management

# Y-12 History – Thorium Parts Production

- Production of metal parts started in 1959
- Thorium pellets pressed into metal electrodes
- Thorium electrodes were arc melted to form ingots
- Ingots from meltings were pressed, rolled and machined
- Metal scraps salvaged and pressed into electrodes
- Radium and progeny volatilized during arc melting
- Major Th processing ended in mid-1970s
- Parts refurbishment and special projects continued until 1999
- Buildings involved: 9202, 9766, 9215

# Thorium exposure potential

- Arc melting releases airborne contamination
- Casting ingots by arc melting disrupts the Th decay chain
- Much of the Radium contained in the metal is vaporized
- Large quantities of radium are released
- Ra-228 constitutes the major radiological hazard
- Ingot has Ra enriched outer layer
- Ra-224 and its sub-series quickly return to equilibrium

# Y-12 History – Pu-241

- Operations staffed by ORNL at Y-12 site, building 9204-3
- Part of ORNL isotope production program
- Pu-241 (and others) produced since 1953 until late 1960s
- Calutrons used for electromagnetic separation of Pu (and other) isotopes for research use
- Facility housed calutrons, gloveboxes, processing laboratory and calutron wash area
- Also provided packaging, storage and shipping
- Production quantities ranged from mg to g

# Pu-241 Exposure Potential

- Initially the low energy beta not considered a concern
- Pu-241 half life is 14.4 years
- High specific activity of 104 Ci/g
- Maximum beta energy is 20.8 keV
- Alpha emitters were focus of internal dose control

# Sources of Available Information

- Site Profile and Technical Information Bulletins and Procedures
- NIOSH Site Research Data Base
- Existing claimant files
- Electronic data bases
- Interviews with former Y-12 employees
- Scientific publications

# Internal Data Availability – Thorium – in-vivo

- Thorium lung counts 1958-1982
- From Y-12 in-vivo facility using NaI detector system
- Thorium results are reported in units of mg of Th
- Need calibration and count/channel data to potentially assess intakes from in-vivo results
- Thorium chain disequilibrium is an issue
- Qualitative method only
- No measurement data for Ra-228
- Change in recording procedure in 1978
- Additional research required on post-1976 data when count data should be available

# Internal Data Availability – Thorium Air data

- GA, BZ and operational data available, majority is GA
- Y-12 Thorium air sample data base has issues with data pedigree and completeness
- BZ and operational samples not sufficient for intake approach for all years

## Internal Data Availability – Pu-241

- Low energy beta (17 keV average) from Pu-241 hard to detect
- No Pu-241 specific bioassay available before method developed in 1967
- Total of 222 samples collected between 1967-1985
- 74 samples from 1967
- Method developed was ion exchange followed by LSC

# Timeline

- SEC-00186: January 1, 1948 through Dec. 31, 1957
- Thorium Operations: January 1, 1959 through December 31, 1976
- Pu-241 operations: January 1, 1954 through December 31, 1966
- Current infeasibility → Jan. 1, 1958 through December 31, 1976
- Path forward: evaluate thorium feasibility beginning January 1, 1977

## Class definition Finding

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, 1958 through December 31, 1976 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.

# Feasibility Findings for Y-12 (SEC00251)

| Internal Source of Exposure | Dose Reconstruction Feasible |
|-----------------------------|------------------------------|
| Uranium                     | Yes                          |
| Plutonium                   | Yes                          |
| Mixed Fission Products      | Yes                          |
| Thorium                     | No                           |
| Pu-241                      | No                           |

| External Source of Exposure | Dose Reconstruction Feasible |
|-----------------------------|------------------------------|
| Beta-Gamma                  | Yes                          |
| Neutron                     | Yes                          |
| Occupational Medical X-ray  | Yes                          |