# Titanium Alloys Manufacturing Special Exposure Cohort Petition Evaluation Report

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# Petition Overview

- July 28, 2011: NIOSH received an 83.13 petition for period of 1950 through 1956
- November 17, 2011: Petition qualified for evaluation
- February 14, 2012: Evaluation Report approved
- SEC class recommended: None

# Background

- **Titanium Alloys Manufacturing (TAM)**
  - **Located in Niagara Falls, New York**
- **TAM produced zirconium tetrachloride for the AEC from 1950 through 1956**
  - **The process did not involve radioactive material**
- **TAM melted 70 pounds of contaminated scrap metal for an AEC experiment in 1955**
- **TAM also reduced uranium in samples in July 1956**

# Background—cont.

- Covered period for TAM as an AWE was previously listed as 1950 through 1956 (same as the SEC petition)
- NIOSH requested DOL review the basis for the covered period
- The covered period as an AWE was changed to 1955 through 1956

# Proposed and Evaluated SEC Class

- **Petitioner-Proposed class:**

  **All employees performing their duties who worked at Titanium Alloys Manufacturing Company in Niagara Falls, NY from 1950 to 1956**

- **Class Evaluated by NIOSH:**

  **All employees who worked in any area or building at Titanium Alloys Manufacturing from January 1, 1955, through December 31, 1956**

# Petition Basis and Concerns

- **Unmonitored workers**
  - **Petitioner presented an affidavit indicating a lack of monitoring for radiation exposures**
  - **NIOSH had a limited amount of records available for airborne radioactivity and surface contamination during uranium reduction in 1956**

# Sources of Available Information

- **Battelle-TBD-6000, Site Profiles for AWEs that Worked Uranium Metals**
- **NIOSH Site Research Database documents**
- **DCAS and ORAUT technical bulletins**
- **Case files in NIOSH OCAS Claims Tracking System**

# Additional Information Obtained During SEC Petition Evaluation

- Published reference on the AEC scrap metal melting operation in 1955
  - Quantity of material
  - Airborne radioactivity and contamination measurements
- AEC Source Material License issued in 1956 for possession and processing of 100 pounds of uranium contained in ore concentrates

# Previous Dose Reconstructions

## NIOSH OCAS Claims Tracking System

**Information available as of January, 2012**

| | |
|---|---|
| ▪ TAM claims submitted to NIOSH | 14 |
| ▪ Claims in the evaluated class | 12 |
| ▪ Dose reconstructions completed for energy employees in the evaluated class | 12 |
| ▪ Claims containing internal dosimetry | 0 |
| ▪ Claims containing external dosimetry | 0 |

# Potential Radiation Exposures During the Contract Period

- **Exposure to uranium from melting contaminated stainless steel and aluminum in 1955 and from reduction of uranium samples in 1956**
  - **Both were experimental operations with limited quantities of material**
  - **External dose from exposure to photon and beta radiation**
  - **Internal dose from airborne radioactivity and surface contamination**

# Source Term for Exposure

- **Contaminated scrap stainless steel and aluminum (1955)**
  - **40 pounds of stainless steel 1/4 inch thick**
  - **30 pounds of aluminum 1/16 to 1/4 inch thick**
  - **Total mass of uranium estimated to be 90 grams based on analytical data**
  - **Maximum surface contamination (total alpha) was 26,800 dpm/100 $cm^2$**

# Source Term for Exposure—cont.

- **Reduction of uranium in samples (1956)**
  - **Uranium compounds including $UF_4$, $UO_2$, and $UF_6$**
  - **Occurred over a two-day period**
  - **An AEC license issued in 1956 authorized TAM to possess up to 100 pounds of uranium contained in ore concentrates for experimental work related to the production of uranium fluorides**
  - **Reports indicate bench-scale type operations involving gram quantities of material**

# Approach to Dose Reconstruction

- **Air sampling and surface contamination data from the operations can be used to estimate bounding intakes of uranium**
- **TBD 6000 can be used to estimate external dose from uranium**

# Pedigree of 1955 Air Sample Data

- Air samples taken by the AEC's Health and Safety Laboratory (HASL) using their standard methods
- Work requested by HASL for the purpose of gathering air data for reclaiming contaminated scrap metal
- Experiment described and air sample results summarized in an article written by two HASL employees and published in *Nucleonics*
- HASL known to employ valid measurement techniques using standard methods and procedures

# Intakes of Uranium from Scrap Melting

- Each type of scrap metal melted in a separate crucible
- Work area had only natural ventilation
- Process air samples had a maximum air concentration (alpha) of 80 dpm/$m^3$
  - All others less than 10 dpm/$m^3$ based on air concentration for the three days in 1955

# Intakes of Uranium from Scrap Melting—cont.

- Workers presumed to be exposed to the maximum concentration for two days of melting
  - One day of decontamination is presumed to have occurred at a concentration of 27 dpm/$m^3$
- Annual inhalation and ingestion intakes derived based on air concentration for the three days in 1955

# Pedigree of 1956 Monitoring Data

- NIOSH has copies of the original air monitoring and surface contamination data sheets
- Recorded on standard forms used by National Lead of Ohio (NLO)
- Forms are the same as those used by HASL
- Data sheets include information on sample location, type, background count-rate, detector efficiency, volume, and filter efficiency
- Alpha measurements made using a scintillation counter

# Intakes from Uranium Reduction Activities (1956)

- Air sample and contamination data are available for July 10-11, 1956, during laboratory and furnace work
- The highest reported air concentration (alpha) was 6 dpm/$m^3$
- Intakes are based on the minimum detectable activity of the air samples, 15 dpm/$m^3$
- Annual inhalation and ingestion intakes were derived based on air concentration for the two days of work

# Potential External Exposure

- Exposure to photons
- Exposure to beta radiation
- Dose from required medical X-rays

# Potential External Exposure—cont.

- **Photon dose rates estimated from TBD 6000 Table 6.1 values for a uranium slug**
  - **Continuous exposure at one foot distance for all days of uranium work (<3 mrem total exposure)**
  - **Shallow dose from beta particles presumed to be a factor of 10 times higher than the photon dose**
- **Annual medical X-rays presumed to be required during the AWE period and doses assigned per TIB 6**

# Evaluation Process

- **Two-prong test established by EEOICPA and incorporated into 42 C.F.R. § 83.13 (c)(1) and 42 C.F.R. § 83.13 (c)(3):**

  1. **Is it feasible to estimate the level of radiation doses of individual members of the class with sufficient accuracy?**

  2. **Is there a reasonable likelihood that such radiation dose may have endangered the health of members of the class?**

# Feasibility of Dose Reconstruction

**The process and source term information provide sufficient information to estimate doses associated with uranium work at Titanium Alloys Manufacturing**

# Summary

| Feasibility Findings for Titanium Alloys Manufacturing Petition<br>January 1955 – December 1956 | | |
|---|---|---|
| **Source of Exposure** | **Reconstruction Feasible** | **Reconstruction NOT Feasible** |
| **Internal** | | |
| - Uranium | X | |
| **External** | | |
| - Uranium beta-gamma | X | |
| - Neutron | N/A | |
| - Occupational Medical X-ray | X | |