

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 cm²

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/m³
 - All others less than 10 dpm/m³ 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/m³
- 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/m³
- Intakes are based on the minimum detectable activity of the air samples, 15 dpm/m³
- 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 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	