Rocky Flats Plant
Special Exposure Cohort
Petition Evaluation Report

Stuart Hinnefeld
Director
National Institute for Occupational Safety and Health
Division of Compensation Analysis and Support

September 2012
Denver, CO

Petition Overview

- August 23, 2011: NIOSH received an 83.13 petition for period of April 1952 to December 21, 2005 (for tritium exposures)
- February 9 2012: Petition qualified for evaluation
- September 5, 2012: Evaluation Report approved
- SEC class recommended: None

Background

- Rocky Flats Plant (RFP)
  - Located in Golden, Colorado
  - 384-acre site, surrounded by ~6000 acre buffer zone
  - Approximately 6000 people maximum workforce (~1990)
  - Located in Golden, Colorado
- RFP primarily produced plutonium triggers for, and recovered plutonium from, nuclear weapons
  - SEC00030 evaluation did not adequately address tritium
  - Work with some pits and special return material entailed some tritium potential

Proposed and Evaluated SEC Class

- **Petitioner-Proposed class:**

  All workers employed at Rocky Flats from April 1, 1952 to December 31, 2005

- **Class Evaluated by NIOSH:**

  All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors with the potential for tritium exposures while working at the Rocky Flats Plant in Golden, Colorado, during the period from April 1, 1952 to December 31, 2005.

Petition Basis and Concerns

- **Unmonitored workers**
  - Petitioner provided information and affidavit statements in support of the petitioner's position that there were times when the petitioner was not monitored, specifically as it related to tritium.
  - NIOSH determined that it has access to personnel or area monitoring data for Rocky Flats workers, specifically applicable to tritium at the time of the 1973 incident.
  - NIOSH determined that a review of tritium records and data for all time periods was appropriate, and sufficient to support qualifying SEC00192 for further evaluation.

Sources of Available Information

- Rocky Flats Plant TBDs (ORAU-TKBS-0011-1 through ORAU-TKBS-0011-6)
- 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

- Interviews with former RFP workers
- Worker Outreach meetings
- Classified records reviews

Previous Dose Reconstructions

NIOSH OCAS Claims Tracking System

Information available as of January, 2012

Totals include claims that are in the earlier SEC classes

- **RFP claims submitted to NIOSH** **1695**
- **Dose reconstructions completed, or claim otherwise dispositioned, for energy employees in the evaluated class** **1605**
- **Claims containing internal dosimetry** **1442**
- **Claims containing tritium bioassay** **122**

Potential Tritium Exposures

- Tritium containers
  - First two designs (pure fission weapons) phased out circa 1957
  - Later design (thermonuclear) had tritium but it was coupled at other sites
- Neutron generators
  - Used tritium targets (total inventory in all machines <250 Ci)
  - Located in five locations on-site
- Radiation interactions
  - Interactions between transuranics and B, Be, and N can produce tritium

Potential Tritium Exposures—cont.

- **Contaminated Returns**
  - The years when contaminated returns could have existed in the MED/AEC complex is not certain; it's possible they were not at RFP until late 1960s
  - Conservative assumption would be that releases from contaminated returns could have occurred at any time since RFP plutonium operations commenced in 1953

Source Term for Exposure

- Neutron generators and radiation interaction not deemed significant
  - Tritium (a total of 241 Ci over the operational period through 1973) in neutron generator targets spread across the site in five different areas
  - Estimates of total tritium generated from radiation interactions range from 0.2 – 3.2 Ci/yr
- Contaminated returns deemed a significant exposure risk

Source Term for Exposure—cont.

- 1973 incident involving contaminated return produced the highest recorded tritium contamination levels
- RFP receipt records from 1970-1974 indicated almost 300 shipments. Four from LLNL were considered likely to have been contaminated with tritium
  - April 1969 ~60 Ci
  - March 1971 ~50 Ci
  - December 1971 ~30 Ci
  - March 1973 500-2000 Ci

Source Term for Exposure—cont.

- In the 1979-1980 time period an evaluation of 1700 LANL 'site return' pits, retrieved from stockpile, showed very little tritium (from 0.015 – 468 mCi/m3)
- In 1984 radiography of pits (to determine structural integrity) was a routine aspect of testing, and was sufficient to determine likely tritium contamination in a pit received from LANL (returned to LANL for disassembly)

Incidents

- Normal site returns were processed by acid dissolution
- Special returns were ‘hydrided’ and the off-gas was burned and filtered before release to the atmosphere – this would result in HTO rather than elemental tritium

Incidents—cont.

- Special project incident in 1968 released ~600 Ci of tritium (no detectable environmental impact due to chemical form of tritium – elemental tritium release versus tritiated water)
- 1973 incident was a special return, and the off-gas was burned resulting in production of HTO and the release of 500-2000 Ci
- 1974 incident – tritium release from a contaminated shipping container amounted to an estimated 1.5 Ci

Monitoring

- Prior to 1973 incident, RFP did not routinely collect bioassay for tritium (as it was not anticipated as a component of their mission)
  - Handful of tritium samples in SRDB prior to 1973 (~30)
  - Special sampling due to 1973 incident well-documented, 148 workers monitored, 5 deemed to have 'potentially significant exposures'
  - Routine sampling program put in place after 1973 incident, abandoned for job-specific sampling in 1975 because the results showed zero positive samples

Monitoring—cont.

- A review of HP, IH, and EM reports for all years indicates limited tritium results
  - Tritium sniffers
  - Triton portable and fixed air monitors
  - Swipe and smear surveys

Monitoring—cont.

- Post-1973, procedures were implemented to sample workers working a job involving more than 1 mCi tritium
    - One document lists 16 names of personnel to be sampled; tritium sampling data for 13 of the 16 were found in the SRDB

Approach to Dose Reconstruction

- Although there were several incidents related to tritium at RFP, only the one in 1973 resulted in significant personnel exposure. Involved personnel were carefully monitored, results are numerous, and are available in the SRDB
- Because of the size and chemical composition of this 1973 release (HTO versus elemental tritium) NIOSH considers this to be a bounding scenario.

Approach to Dose Reconstruction

- Rocky Flats started processing the contaminated returns in April 1973, not knowing that they were contaminated
- In June 1973, the state of Colorado detected tritium in surrounding surface waters and notified Rocky Flats; Rocky Flats maintained that it could not have been the source
- In September 1973, Rocky Flats started investigating and found tritium in multiple unexpected locations in the workplace

Approach to Dose Reconstruction

- Bioassay samples were collected from 148 employees who were judged to have been potentially exposed to tritium

- Dose estimates were prepared for employees with the highest bioassay results, using “worst case” and “best fit” approaches. The “worst case” result of 753 mrem/year will be adopted as the internal tritium dose for all workers from the beginning of Pu operations through 1973 to account for potential doses from unidentified, but presumably smaller, earlier occurrences of contaminated returns

Approach to Dose Reconstruction

- Because of the extent of time over which tritium exposures likely occurred (from receipt in April until investigation in September), tritium exposures from this incident were more chronic in nature, rather than single acute exposures. This chronic exposure experience is analogous to what would have occurred if there were other unidentified receipts of contaminated returns

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 incident information, along with administrative controls and environmental, area, and personnel sampling, provide sufficient information to estimate doses associated with tritium work at the Rocky Flats Plant

Summary

Feasibility Findings for Titanium Alloys Manufacturing Petition January 1955 – December 1956		
Source of Exposure	**Reconstruction Feasible**	**Reconstruction NOT Feasible**
Internal	**X**	
- Tritium	**X**	
External	**N/A**	