Linde Ceramics Plant
Special Exposure Cohort
Petition Evaluation Report
Revision 1

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Petition Overview

- Petition received on November 5, 2009
- Petitioner proposed class definition:
  - All employees who worked in any area at the Linde Ceramics in Tonawanda, NY, from November 1, 1947 to December 31, 1953
- Petition qualified for evaluation on January 22, 2010

Petition Overview—cont.

- Class evaluated by NIOSH
  - All employees who worked in any area at the Linde Ceramics Plant in Tonawanda, NY, from November 1, 1947 to December 31, 1953
- Covered periods at Linde Ceramics Plant
  - Contract period extends from October 1, 1942 through December 31, 1953
  - Residual contamination continues through October 2009
- Previously added SEC classes
  - October 1, 1942 through October 31, 1947
  - January 1, 1954 through December 31, 1969

Evaluation Report Background

- Original evaluation report presented to the Advisory Board in November 2010
- NIOSH believed at that time that all doses could be reconstructed with sufficient accuracy
  - Ability to reconstruct internal doses largely based on the existence of >600 uranium urinalysis samples collected between 1947 and 1950
- Detailed review of available samples and operations between 1947 and 1953 has been conducted

Linde Ceramic Plant's AEC Activities

- Linde Ceramics Plant (a division of Linde Air Products Corporation) located in Tonawanda, New York
- Originally handled uranium products used as dyes for ceramic tableware
- In 1942, contracted with the Manhattan Engineering District (MED) to process uranium ores to produce uranium oxide and later, green salt

Linde Ceramic Plant's AEC Activities—cont.

- In 1942 and thereafter, the MED erected several buildings (30, 31, 37, and 38) at the site, which became known as the Linde Ceramics Plant

- The MED contracted for the processing of uranium ores into green salt in a 3-step process extending from October 1, 1942 through June 30, 1949

Chemical Processes at Linde Ceramics Plant

- **Step 1**
  - Conversion of uranium ore to U_3O_8 (black oxide)
  - Unrefined ore contained U progeny in equilibrium
  - Occurred in Building 30
- **Step 2**
  - Conversion of U_3O_8 to UO_2 (brown oxide)
  - UO_3 (orange oxide) was an intermediary product
  - Occurred in Building 30
- **Step 3**
  - Conversion of UO_2 to UF_4 (green salt)
  - Occurred in Buildings 37 and 38

Major Operations (1947 – 1953)

- Production of UF_4 in Building 38
  - November 1, 1947 – June 30, 1949
  - $UO_2 + 4HF \rightarrow UF_4 + 2H_2O$
  - Started with purified U, so no exposure to progeny
- D&D of Building 30
  - Some step 2 process equipment removed starting in April 1948
  - Extensive D&D activities (e.g., sand blasting, removal of contaminated parts, jack hammering) started in May 1949 and completed February 1950
  - Potential for exposure to U and progeny

Building 38 After June 30, 1949

- Decontamination efforts not well documented
- Minor cleanup performed at the end of operations and equipment placed in standby mode
- Memos indicate that decontamination efforts occurred sometime between 1950 and 1953
- NIOSH has no internal monitoring data for these efforts

Review of Urinalysis Data

- Urine samples collected between 1947 and 1950 measured for mass of uranium only
- Most samples appear to have been collected to monitor workers in Building 38
  - Fluorine results reported in addition to U
- Mass measurements incapable of evaluating intakes of long lived progeny present in Building 30
- No bioassay or air sample data available after 1950
- D&D operations conducted in Building 38 sometime after 1950

Feasibility - Internal Dose

- Building 38 decontaminated after July 1949 by workers who were either unmonitored or for whom the monitoring records have been lost
- Building 30 contaminated with raffinate material and, after 1950, with residual material that included some raffinates of unknown concentration
- Available bioassay data incapable of quantifying exposures in either situation

Feasibility - Radon

- All above ground structures assumed to have a 10 pCi/L radon level, per the Technical Basis Document, Table 3-5
- Documentation indicates that the utility tunnels near the Linde Ceramics Plant (Buildings 30, 31, 37, and 38) were not built until after 1956
- Documentation and soil samples show that the Bldg. 14 area was not contaminated with radium so that the surface radon levels are bounding for the existing utility tunnel

Feasibility – External Dose

- Principal sources of exposure
  - Direct beta/gamma from uranium and progeny contained in process material
  - Residual contamination present on surfaces
- Approximately 6,000 weekly film badge results available
  - Allows for correlation between job category and measured dose
- Radiation area survey data available to supplement film badge data

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

- **NIOSH finds that the available monitoring records, process descriptions, and source-term data are insufficient to bound internal doses or to complete dose reconstructions with sufficient accuracy for the evaluated class of employees**

Health Endangerment

- The evidence reviewed in this evaluation indicates that some workers in the class may have accumulated chronic radiation exposures through intakes of radionuclides and direct exposure to radioactive materials
- Consequently, NIOSH is specifying that health may have been endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class or in combination with work days within the parameters established for one or more other classes of employees in the SEC

NIOSH Recommendation

All employees who worked in any area at the Linde Ceramics Plant in Tonawanda, New York, from November 1, 1947 through December 31, 1953, 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

NIOSH Recommendation—cont.

Summary of Feasibility (November 1, 1947 through December 31, 1953)		
Source of Exposure	**Feasible**	**Not Feasible**
Internal		
U and progeny		**X**
Radon	**X**	
External		
Gamma, Beta, and neutron	**X**	
Medical	**X (1950-1953)**	