

Blockson Chemical Company Special Exposure Cohort

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Petition Overview

- Special Exposure Cohort petition received February 25, 2015
- Petitioner requested class definition:

All maintenance and operations personnel who worked in any area at Blockson Chemical Co. in Joliet, Illinois, during the period from July 1, 1960 through December 31, 1991.



Petition Overview

- Qualified for evaluation on May 5, 2015
- Basis for qualification:
 - Radiation exposures incurred by members of the proposed class were not monitored either through personal or area monitoring
- Some area monitoring results are available



Petition Overview

- The class evaluated by NIOSH:

All employees who worked in any area at the Blockson Chemical Co. site in Joliet, Illinois, during the period from July 1, 1960 through December 31, 1991



Previous Evaluation

- SEC petition for 1951 through 1962
- The Board deemed the methods to estimate radon dose from Building 40 during the Atomic Weapons Employer (AWE) operational period not sufficiently accurate
- Class added to the SEC for all workers at Blockson from March 1, 1951 through June 30, 1960



Data Sources

- DCAS-TKBS-0002, *Technical Basis Document for Atomic Energy Operations at Blockson Chemical, Joliet, Illinois*
- Technical Information Bulletins
- Information from petitioners and former workers
- NIOSH Site Research Database (SRDB)
- Previous dose reconstructions



Previous Dose Reconstructions

- Total claims submitted for dose reconstruction 143
- Cases submitted for energy employees who worked during the period under evaluation (7/1/1960 – 12/31/1991) 130
- Number of dose reconstructions completed for energy employees who worked during the period under evaluation 127
- Cases for which internal dosimetry records were obtained 0
- Claims for which external dosimetry records were obtained 0



Facility Background

- Blockson processed Florida phosphate rock into phosphoric acid and other chemicals
- Processed about 6,000 tons phosphate rock per week
- Phosphate rock contained about 0.012% uranium
- Contracted in 1951 with the Atomic Energy Commission to develop process to recover uranium as byproduct
- Blockson modified their process and built Building 55 for uranium recovery operations



Blockson Phosphate Process

- Used the *wet process* to produce phosphoric acid
 - Phosphate rock was calcined and transferred to Building 40
 - Rock was pulverized and digested in sulfuric acid to produce phosphoric acid and precipitated phosphogypsum waste
 - Waste contained radium which was deposited into large outdoor piles known as phosphogypsum stacks



Uranium Recovery Process

- The phosphoric acid product stream contained most of the uranium
- The acid was partially neutralized to form monosodium phosphate and then diverted to Building 55
- Used a multistep process to precipitate and then concentrate the uranium
- Phosphate stream returned to other plants for processing into commercial chemicals



Uranium Product

- Uranium concentrates dried and packaged in drums for shipment to the AEC
- Final product contained 40-50% uranium
- Production ended in 1960
- Blockson recovered 118.3 tons of uranium from 1952 through June 1960



Sources of Residual Contamination

- Internal and external doses from uranium contamination
- Dose from progeny and associated radionuclides
- Exposure to radon
- Building 55 is used to bound dose from residual AEC-related contamination
- Phosphogypsum stacks bound radon exposures from AEC-related waste



Radiological Data

- Bioassay data from uranium recovery workers
 - Samples collected from 25 workers between 1954 and 1958
- Air sampling performed in 1978 and 1983
- Contamination and radiation surveys performed in 1978
- Radon monitoring data
 - Measurements in 1978 and 1983
 - Flux data from phosphogypsum piles in 1993



Internal Dose

- TBD provides intakes of uranium during operations—used for start of residual period
 - Bounding value of 13 pCi/day
- Contamination data from Building 55 in 1978 used to estimate intakes in 1978
 - Intake from resuspension equals 0.28 pCi/day
- Values used to determine exponential depletion rate and annual intake estimates



Internal Dose

- TBD methods and values favorable in comparison with methods described in ORAUT-OTIB-0070
- Both inhalation and ingestion pathways considered
- Intakes of associated radionuclides based on intakes of uranium



External Dose

- External dose rate measurements in 1978
 - Surveys taken in Building 55
- Dose rates from hot spots were used to estimate annual dose rates
- Hot spots were from normally inaccessible locations
- Assigned as a lognormal distribution
 - Median value is 0.03 mR/hr with 95th percentile of 0.2 mR/hr



External Dose

- Annual photon dose of 0.060 rem
- Allows for dose from beta radiation
- Favorable in comparison with dose estimates based on general contamination survey data
- Includes dose from contamination that accrued from commercial operations during the residual period



Radon Exposures

- Radon measured in 1978 and 1983
 - Building 55 values in 1978 ranged from 0.14 to 0.61 pCi/Liter
 - Single measurement of phosphogypsum area was <0.0042 WL
- Radon from active phosphate work not applicable
- Phosphogypsum stacks are presumed to bound radon exposures from residual AEC-related waste
- Radon flux measurements taken of inactive stacks in 1993



Radon Exposures

- 10.1 pCi/m²-s highest mean value reported for sides of Blockson stacks in 1993
- Radon air concentrations not provided
- Texas City Chemicals inactive phosphogypsum stack had similar radon flux and provided associated radon concentrations
 - Evaluated against IG-004 surrogate data criteria
- Maximum 0.42 pCi/L concentration from Texas City also presumed for Blockson in 1993



Radon Exposures

- Factor of 5 adjustment made to allow for concentration from an *active* stack
- 2.1 pCi/L estimated for Blockson in 1960
- Exponential depletion presumed to connect the 1960 and 1993 values
- Annual exposures bound all available radon data for Blockson



Feasibility Summary

July 1, 1960 through December 31, 1991		
Source of Exposure	Feasible	Not Feasible
Internal Dose	X	
Radon Exposure	X	
External Dose	X	

