Grand Junction Facilities

Special Exposure Cohort

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Facility

- Department of Energy (DOE) facility in Grand Junction, Colorado
- Covered period 1943-present
- Processed thousands of samples, including ores and tailings
- Numerous projects used large quantities of ores and tailings to for materials and calibration pads

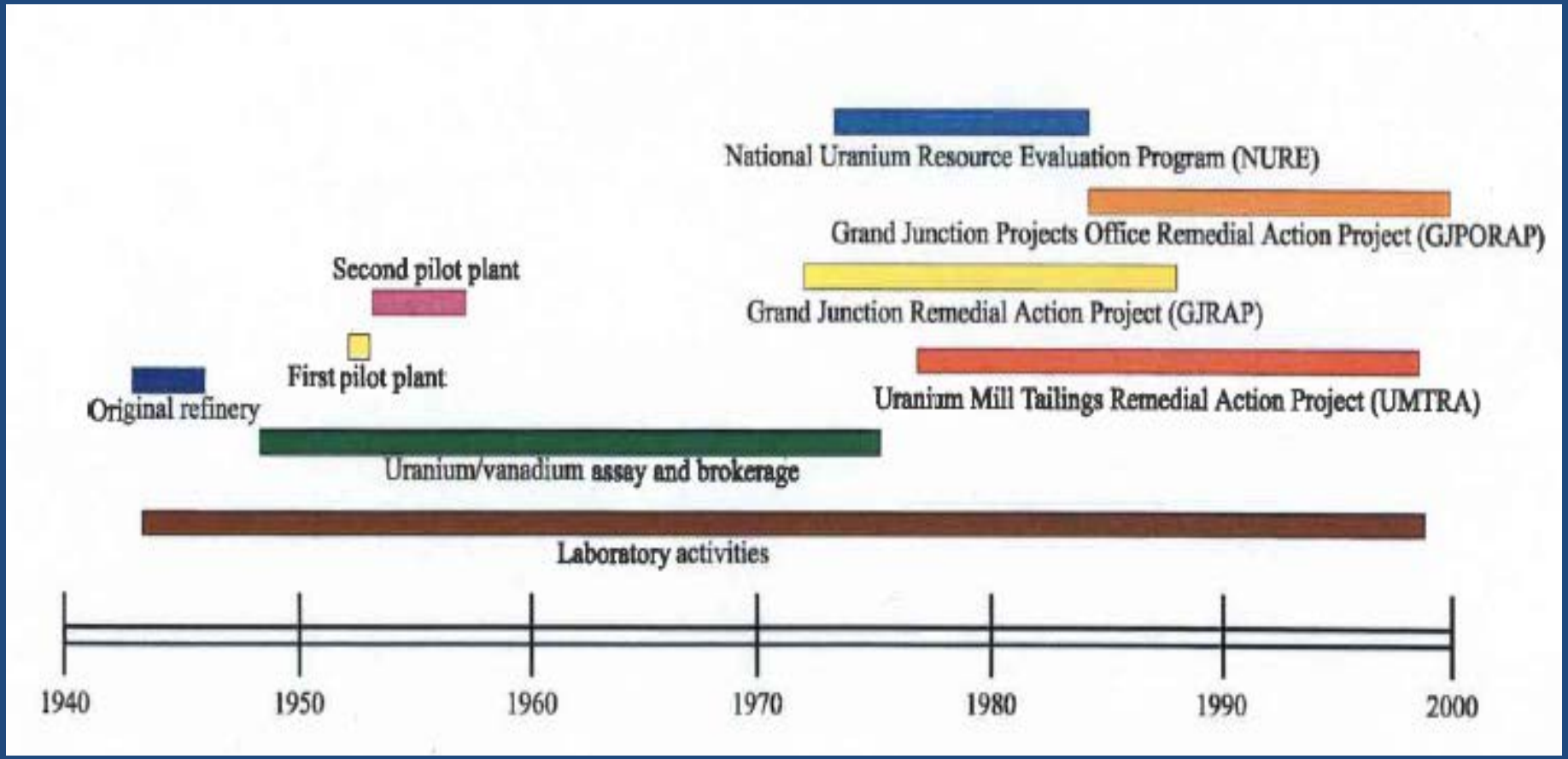
Site History

- March 23, 1943 US Army established the Colorado Area Engineer Office
- Site later became the Grand Junction Operations Office (GJOO)
- Refinery plant construction and operation to make uranium concentrates for the Manhattan Engineer District (MED)
- Post 1945 GJOO was the center of uranium ore exploration, procurement, processing, and sampling activities

Site History

- 347 million pounds of uranium concentrates received, sampled, assayed in the Analytical Laboratory, last drums of materials shipped sent off site January 1975
- Operated two pilot plants in the 1950s to develop methods of extracting uranium from ores, with the ore tailings buried on site
- Managed National Uranium Resource Evaluation (NURE) program 1974-84 (exploration and sampling nation's uranium reserves)

Major Projects and Operations Timeline



Petition History

- Special Exposure Cohort (SEC) petition received June 30, 2010 then qualified for evaluation September 7, 2010 based on lack of monitoring records
- Covered all on-site personnel who worked at the Grand Junction Operations Office from January 1, 1943 through July 31, 2010
- The Board voted to recommend adding worker class from March 23, 1945 – January 31, 1975 to the SEC

Petition History

- NIOSH let the Board know work will continue on the January 1975 through July 2010 time period
- NIOSH drafted the Evaluation Report (ER) Addendum with a proposed class for post 1975
- NIOSH lacks sufficient information to fully reconstruct internal doses from processing of those materials prior to January 1, 1986

NIOSH Post-1975 Findings

- Legacy Contamination of soil and buildings from prior work
- Buried uranium ore tailings from 1950s Pilot Plants
- Continuing operations
- Many activities occurred offsite
- Sample processing greatest potential for exposure

Continuing Operations

- Crushing and grinding samples, ores, and tailings
- Analytical Laboratory operated through 2003 to support the various site projects
- NURE program from 1974 - 1984
- Uranium Mill Tailings Remedial Action (UMTRA) program, offsite remediation in 1980s and 1990s
- Grand Junction Remedial Action Project (GJRAP), offsite remediation in 1970s and 1980s
- Grand Junction Projects Office Remedial Action Project (GJPORAP) from 1988

Crushing and Grinding

- Sample Preparation Laboratory in Building 7A
- Considered greatest source of internal dose from on-site operations after January 1975
- Dust from work area was ventilated to a baghouse
- Processed thousands of samples for Analytical Laboratory
- Numerous projects through 1988 to grind uranium ores, tailings, and thorium ores to specified mesh size prior to downblending into reference materials and for use in calibration pads

Analytical Laboratory

- Building 20
- Assayed uranium ores, concentrates, and other samples in support of site projects
- Had upper concentration limits on incoming samples
- Samples prepared in Building 7A
- Permanently closed in 2003

Sources of Available Information

- ORAU Team Technical Information Bulletins (TIBs) and Procedures
- Interviews with 9 former employees
- Claimant files
- Documentation from petitioner
- NIOSH Site Research Database (SRDB) 1,116 additional documents added
- Additional data capture efforts

Additional Data Capture Efforts

- Atomic Energy Commission (AEC)
- DOE Opennet (OSTI database)
- Internet search
- DOE Comprehensive Epidemiological Data Resource (CEDR)
- NARA Atlanta
- DOE sites

Claims

- 75 Grand Junction claims submitted to NIOSH
- 48 Claims with employment in the evaluated class
- 47 DRs completed for claims with employment in the evaluated class
  - 10 Claims with a PoC > 50%
  - 37 Claims with a PoC < 50%
  - 6 Claims containing internal dosimetry
  - 22 Claims containing external dosimetry

External Exposure Sources

- Direct radiation from handling and processing the ore and tailings
- Submersion in contaminated air
- Contaminated buildings, grounds, and buried tailings
- Sealed sources for data loggers

External Sources of Exposure—cont.

- Photons
  - Uranium and progeny
  - Largest source was radium
- Beta
  - Uranium progeny (protactinium)
- Neutrons
  - Californium-252
  - Zetatrons

External Dose Reconstruction

- Photons
  - Some dosimetry records in claim files
  - REMS database results modified for missed dose used to supplement records
- Beta
  - Beta:gamma ratio used to supplement individual records
- Neutrons
  - REMS data available starting in 1985
  - Prior years assumed to be similar

External DR Feasibility

- Enough information exists to estimate external doses from on-site operations with sufficient accuracy from February 1, 1975 through July 31, 2010
- Can estimate with sufficient accuracy medical x-ray dose using existing program technical documents

Internal Sources of Exposure

- Uranium (main source of exposure)
- Uranium progeny (Th-230 and Ra-226)
- Thorium in limited quantities
- Thorium progeny

Internal Sources of Exposure

- Inhalation and ingestion from sample preparation and preparation of ores used in calibration models: crushing, grinding, drying in Building 7A
- Downblending of ores and tailings used in reference materials and calibration models in Building 7
- Residual contamination from previous operations and airborne radioactivity from site remediation

Available Bioassay Data

- None from 1975 through 1983
- Very few sample samples for on-site workers in 1984 (mostly baseline samples)
- Fecal samples for Samples Prep Lab workers in 1986
- Some bioassay samples available starting in 1991 when more rigorous requirements were implemented

Available Air Sampling Data

- No available data from 1975 through 1979
- Maximum air sample result reported for Sample Prep Lab from samples taken in July 1980
- MPC-Hr tracking for Sample Prep Lab in 1st quarter of 1986: maximum 307 MPC-Hr
- Air sample results reported for Sample Prep Lab in 1990

Available Air Sampling Data

- Three on-site environmental air sampling stations initiated in July 1985
- Environmental air monitoring discontinued in 1994 after open land was remediated
- During site remediation there are records of air monitoring, surface contamination measurements, and worker bioassay

Radon Data

- Radon (in pCi/l)
  - 1967 – 7 results (outdoors)
  - 1968 – 9 results (outdoors)
  - 1990 – 27 results (indoors/multiple buildings)
- Radon Daughters (in WL)
  - 1985 – 300 results (3 buildings)
  - Characterization data in building closeout reports

Internal Dose Feasibility

Sample preparation and processing of ores/tailings used in reference materials and calibration models:

- **There are insufficient data and information to reconstruct maximum internal dose for intakes from February 1, 1975 through December 31, 1985**
- **There are sufficient data and information to reconstruct maximum dose from January 1, 1986 through July 10, 2010**

Internal Dose Feasibility

Intakes of uranium, thorium and their associated long lived progeny cannot be reconstructed from February 1, 1975 through December 1, 1985 due to:

- Lack of air monitoring
- Lack of bioassay data
- Insufficient information to model intakes based on source term

Internal Dose Feasibility

Methods have been developed to estimate dose from radon and radon progeny from February 1, 1975 through July 31, 2010:

- Buildings and areas from previous ore and tailings processing activities are presumed to be the greatest source of radon exposure
- Radon levels measured in the 1980s prior to remediation are presumed to be sufficient to estimate exposures starting February 1, 1975

Internal Dose Feasibility

Uranium, thorium and their long-lived progeny internal dose reconstruction methodology January 1, 1986

Most significant sources of internal dose:

- Sample Prep Lab activities
- Site remediation and building demolition

Internal Dose Feasibility

Sample Prep Lab uranium, thorium and their long-lived progeny internal dose reconstruction January 1, 1986, through December 31, 1991:

- Maximum intakes can be based on the quarterly limit (520 MPC-Hr)
  - Supported by MPC-Hr tracking and bioassay in 1986, and air monitoring from 1990
  - Assumes no significant changes in Building 7A after 1986

Internal Dose Feasibility

Intakes from site remediation and building demolition January 1, 1988, through December 31, 1991

- **Air sampling data are available and have been analyzed**
- **"Operator" dose assigned based on the 95th percentile of the air sample results**
- **Other personnel assigned intakes using a graded approach similar to TBD-6000**

Internal Dose Feasibility

Intakes of uranium, thorium and their long-lived progeny internal dose reconstruction starting January 1, 1992

- Maximum intake for an unmonitored radiation worker based on 200 DAC-Hr per year airborne trigger levels for bioassay
- Intakes for non-radiation workers can be bounded based on 40 DAC-Hr per year trigger levels for air sampling

Summary of Feasibility Findings

Sources of Exposure	2/1/1975 through 12/31/1985		1/1/1986 through 7/31/2010	
	DR Feasible	DR Not Feasible	DR Feasible	DR Not Feasible
Internal		X	X	
Radon	X		X	
Thorium, Uranium		X	X	
External	X		X	
Gamma	X		X	
Beta	X		X	
Neutron	X		X	
X-ray	X		X	

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

Recommendation

- For the period March 23, 1943 – January 31, 1975, NIOSH finds that radiation dose estimates cannot be reconstructed for compensation purposes

Class	Feasibility	Health Endangerment
February 1, 1975 – December 31, 1985	No	Yes

Proposed Class

"All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked at the Grand Junction Facilities Site from February 1, 1975 through December 31, 1985, 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."