

# Uranium Mining TENORM Report and More

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Recovery Workshop



# Uranium Mining TENORM Report

- Report is follow-up and update to previous EPA reports on uranium mining, and uranium mining wastes but focusing on TENORM wastes and risks
- EPA meetings with its Science Advisory Board in 2001 affirmed general content of new report, SAB recommended coverage of all industry sector activities regardless of agency authorities



# Previous EPA Reports

- **1983 (ORIA) -- Report to Congress on the Potential Health and Environmental Hazards of Uranium Mine Wastes**
- **1985 (OSW) -- Report to Congress on Wastes from the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden from Uranium Mining, and Oil Shale**
- **1993/1994 (ORIA) -- Draft Diffuse NORM Risk Assessment and Waste Characterization. SAB review**
- **1995 (OSW)--Extraction and Beneficiation of Ores and Minerals: Uranium**

# Volume I

- Provides overview of U.S. uranium mining history, mining methods, wastes generated including physical and chemical characteristics, waste volumes, reclamation methods
- Peer and outside reviews of draft report, fall 2004
- Final release planned soon – Volume I
  - **Will include statutory and regulatory responsibility appendix-clarifications on agency oversights**
  - **Plus other revisions based on comments received**

# Volume I

- **Overburden radium-226 ranges:**
  - 58 samples from 17 mines,
  - 69% > 5 pCi/g and
  - 50% > 20 pCi/g (EPA 1985)
- Values >20 pCi/g unusual, protore 30–600 pCi/g (Otton-USGS 1998)
- White King 53 pCi/g in near surface overburden while Lucky Lass sample had only 2 pCi/g (Weston 1997)



# Volume I

- **Estimated overburden produced by surface and underground mining ~4000 producers (Ottom – USGS 1998 for EPA)**
- **These estimates may be low considering the numbers of sites identified by the EPA GIS effort**
- **Surface mining produced 45 times more overburden than underground mines**

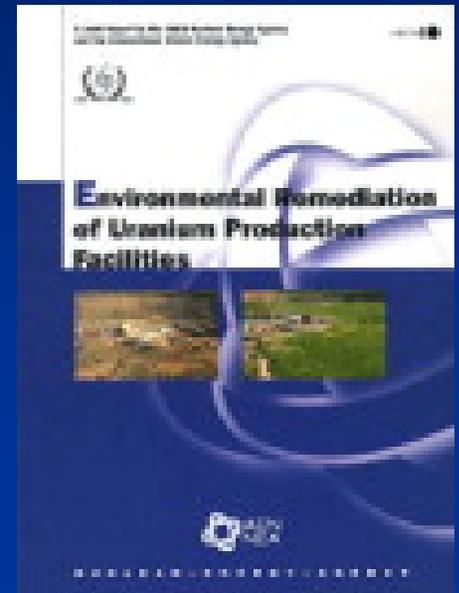
MINING METHOD	ESTIMATED OVERBURDEN PRODUCED (MT)		
	LOW ESTIMATE	HIGH ESTIMATE	AVERAGE
Surface Mining	1,000,000,000	8,000,000,000	3,000,000,000
Underground Mining	5,000,000	100,000,000	67,000,000

# Volume I

- **DOE 2000 study of costs of remediating 21 uranium mines**
  - Reclamation costs ranged from \$0.24/MT of ore produced and \$2,337/hectare of disturbance, to \$33.33/MT of ore and \$269,531/hectare of disturbance
  - Average total estimated reclamation cost was \$13.9 million per mine -- Differences based on mine size, accounting methods

# Volume I

- **DOE 21 mine sites studied:**
  - **96.9 million MT ore, 114,803 MT of uranium**
  - **Lowest cost of closure, \$/lb uranium yellowcake: \$0.18**
  - **Highest cost of closure, \$/lb uranium yellowcake: \$23.74**
  - **Cost data developed for 2002 IAEA/NEA report**



# Volume II

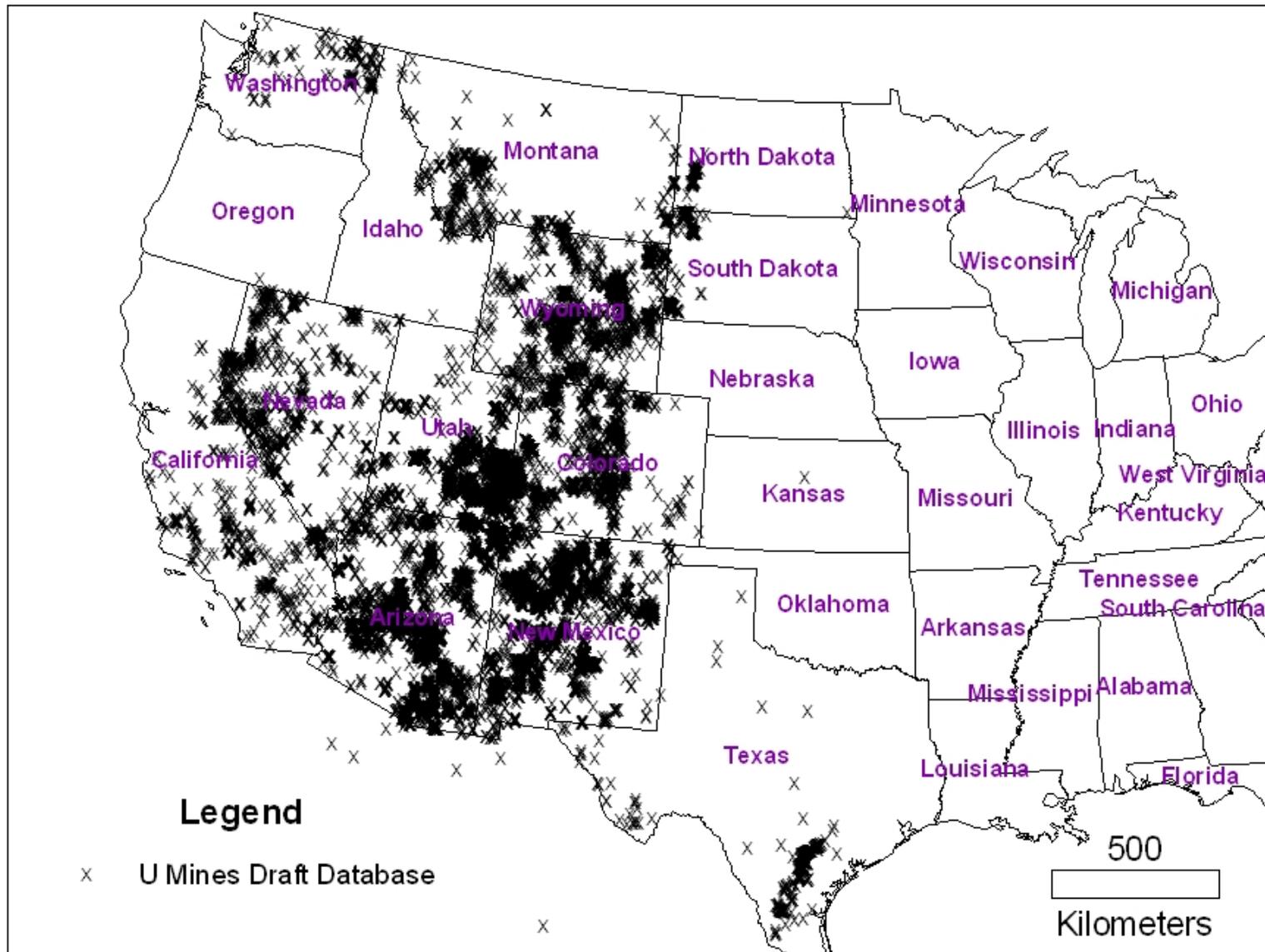
- Results and analyses derived from EPA's uranium mining geographic information system (GIS) database
- Generalized risk assessments (cancer risk) from exposures to TENORM wastes from abandoned uranium mines
- Review of cancer risks associated with other aspects of uranium mines as reported in previous EPA and other studies

# Volume II

- Regional GIS co-operation project, covers 14 western states; approximately 15,000 mines with uranium records in combined data bases
- Provides spatial co-location information for use in evaluating most likely stakeholder populations and exposure situations to uranium mining TENORM
- EPA field studies, GIS analyses, EPA SAB recommendations determined most likely exposure situations for modeling general exposure risk

# US Locations of Mines With Uranium

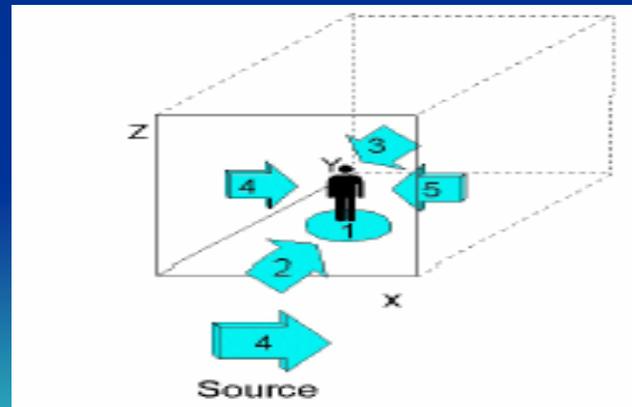
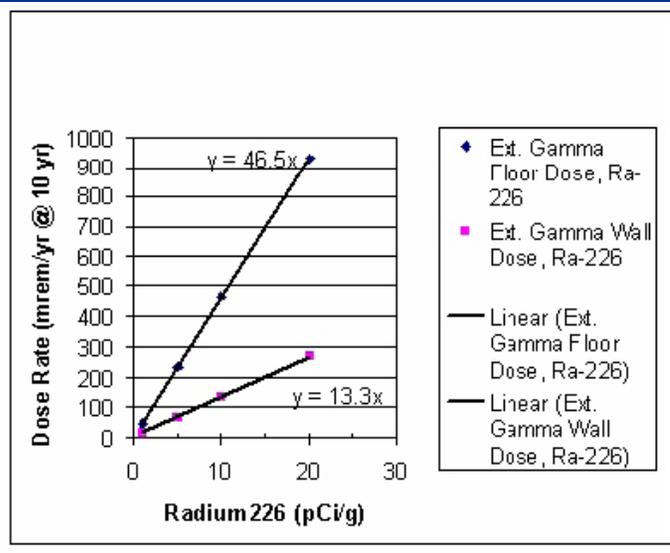
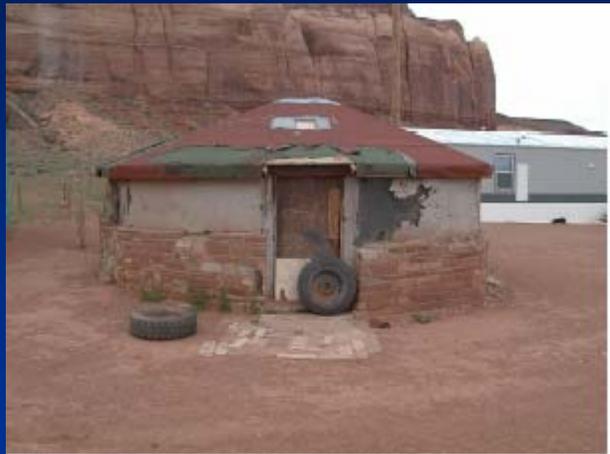
## EPA Draft Database



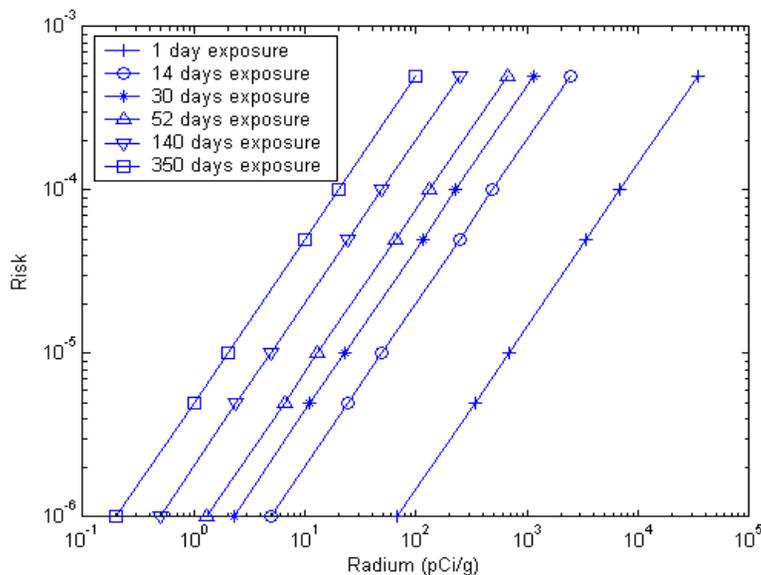
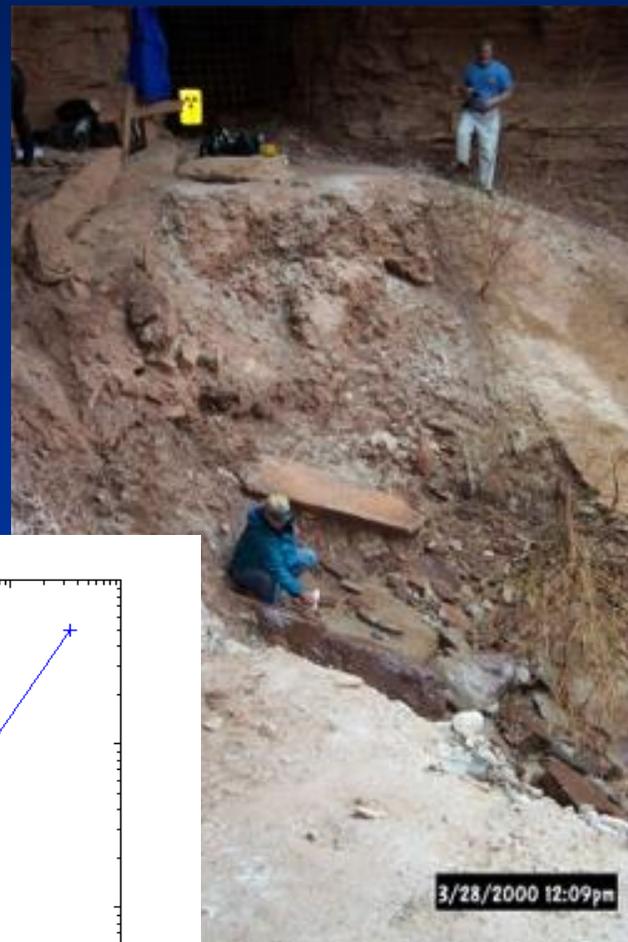
# Risk Modeling -- Approaches

- Per EPA SAB recommendations, variety of computer models examined. Used for analyses:
  - **Soil Screening Guidance for Radionuclides (U.S. EPA 2000)**
  - **RESRAD BUILD**
- Most likely exposure situations:
  - **Individuals building with, on, or adjacent to uranium mine waste, recreation situations, worker exposures**
  - **Exposures on Federal and Tribal lands**

# Modeling Scenarios – Building Materials



# Modeling Scenarios – Recreational and Workers



# Stakeholder Involvement

- A part of EPA's TENORM program strategy
  - Will be designed to determine interest and need for EPA technical, education, other assistance
  - Intended to find ways to partner to reduce radiation exposures



# And More – Assistance to Tribes

- Assistance to EPA Regions 9 and 10 in uranium issues on Tribal lands
- Navajo contaminated homes grant
  - Identify locations of homes potentially constructed with uranium mine waste rock
  - Development of radiation protection standards
  - Development of survey methods and action levels

# And More -- Radionuclide MCLs

- **Final Drinking Water Rule Promulgated in late 2000**
  - Retained the maximum contaminant levels (MCLs) for combined Radium-226/228, gross alpha particle activity, and beta particle and photon radioactivity in drinking water
  - Set a new MCL for uranium
  - Established separate monitoring requirements for Radium-228; and
  - Required systems to monitor at each entry point to the distribution system.
- **Compliance Activities Required Starting in 2003**
  - By December 31, 2007, all drinking water systems must complete initial monitoring.

# And More -- Radionuclide MCLs

- Standards

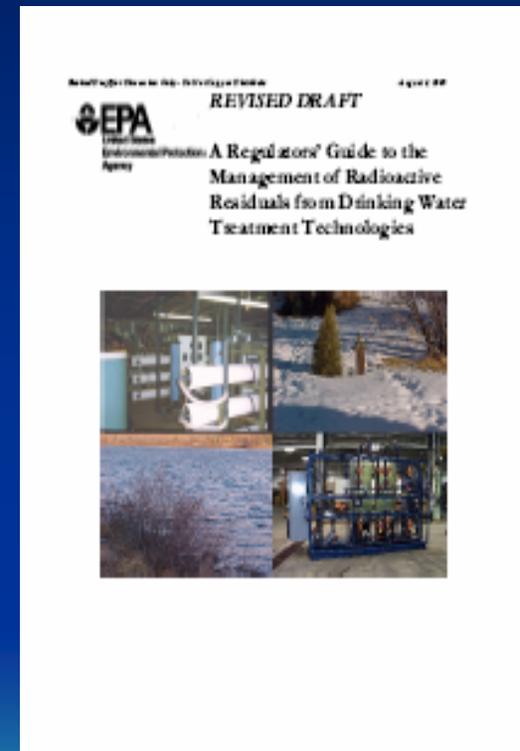
Radionuclide	Level
Combined radium-226 and 228	5 pCi/L
Gross alpha particle activity (excluding radon and uranium)	15 pCi/L
Beta particle and photon radioactivity	4 mrem/year
Uranium	30 ug/L

# And More -- Radionuclide MCLs

- Draft EPA Regulator's Guide
- Estimation Tool (SPARRC)
  - Spreadsheet Program to Ascertain Radionuclides Residuals Concentration
- Technical and Regulatory Assistance
  - Waste Disposal
  - Worker Exposure and Safety Issues

# And More -- Radionuclide MCLs

- **Draft EPA Regulator's Guide** provides information on:
  - Treatment technologies
  - Applicable statutes and regulations
  - Radiation fundamentals
  - Waste disposal options
  - Worker exposure and safety
  - State and regional contacts



# And More -- Radionuclide MCLs

- Treatment technologies discussed:
  - Ion Exchange and Point of Use Ion Exchange
  - Reverse Osmosis and Point of Use Reverse Osmosis
  - Lime Softening
  - Green Sand Filtering
  - Co-precipitation with Barium Sulfate
  - Electrodialysis/ Electrodialysis Reversal
  - Pre-formed Hydrous Manganese Oxide Filtration
  - Activated Alumina
  - Coagulation/ Filtration

# And More -- Radionuclide MCLs

- Treatment Residuals -- Solids and liquid wastes : pipe scale, filters, residuals, backwash, brines, sludges



# And More -- Radionuclide MCLs

- **Disposal Options -- Sanitary sewer, lagoons, industrial or hazardous waste landfills, radioactive waste disposal sites, enhanced recovery or deep disposal wells (class II UIC wells)**



# And More -- Radionuclide MCLs

- **ANPR for low-activity radioactive waste disposal:**
  - Potentially includes a large universe of low activity waste including naturally occurring radionuclides
  - Focus on disposal in RCRA hazardous waste landfills
  - Analysis could provide insight towards management decisions for water treatment residuals

# Summary

- **EPA is completing technical reports on uranium mining TENORM in preparation for determining its next assistance steps with stakeholders**
- **EPA is developing waste management guidance for states and public water systems on implementation of the recent radionuclide MCL rule**