Uranium Mining TENORM Report and More

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2005 NMA/NRC Uranium Recovery Workshop

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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**

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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**

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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)**

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Volume I

- **Estimated overburden produced by surface and underground mining ~4000 producers (Otton – 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

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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**

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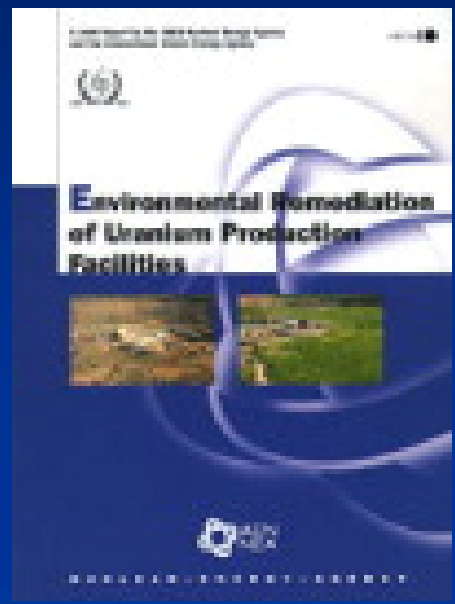
Volume I

- **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**



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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

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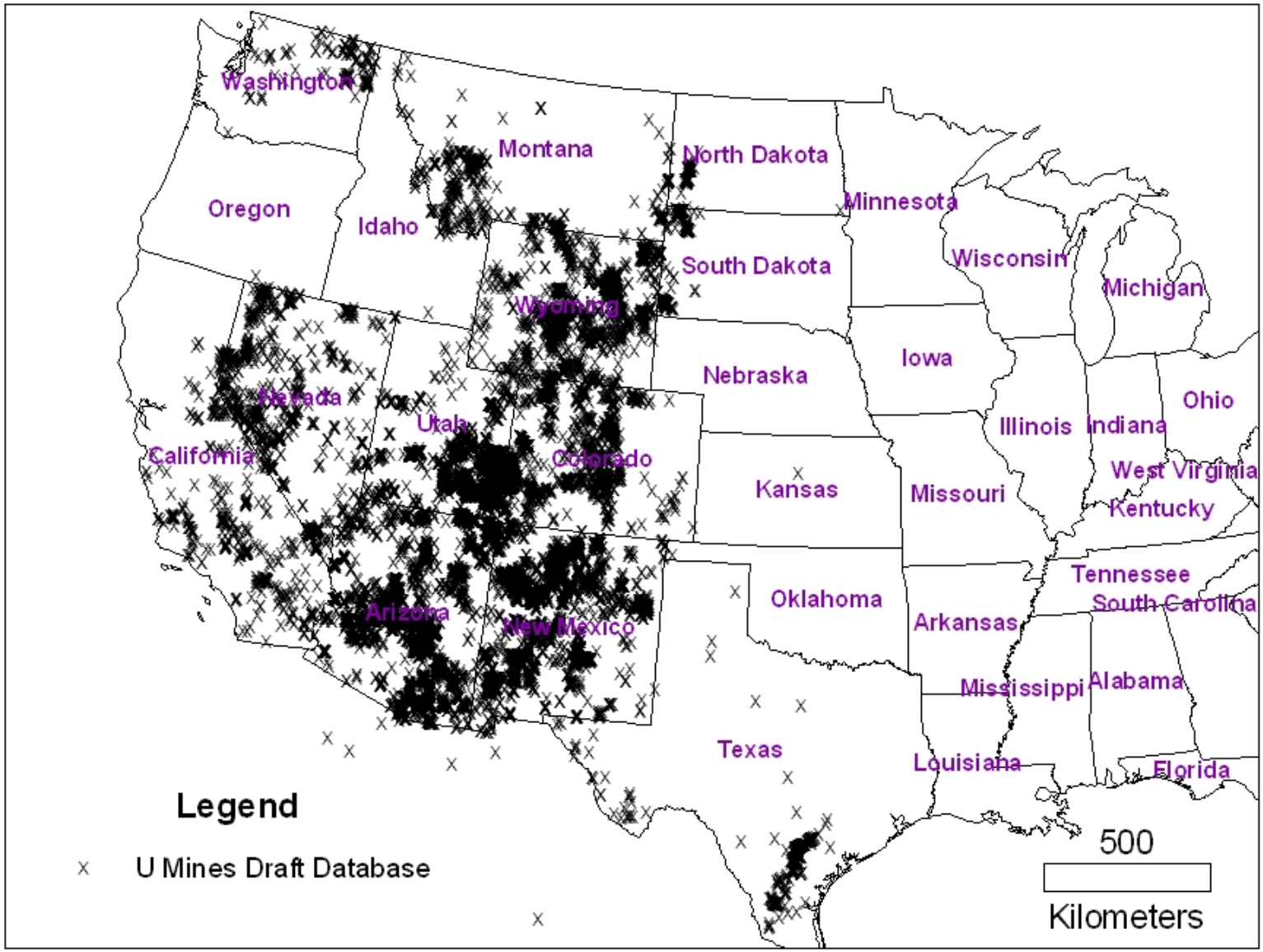
US Locations of Mines With Uranium

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**

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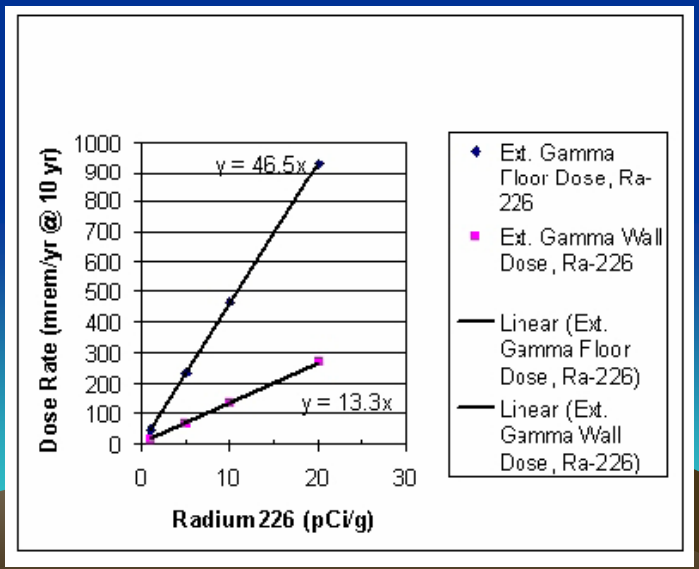
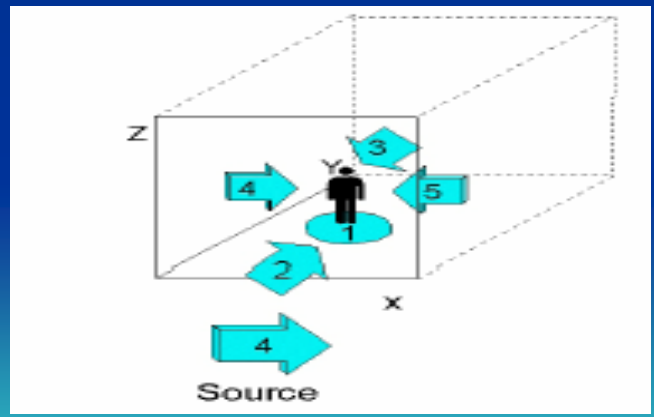
Modeling Scenarios – Building Materials





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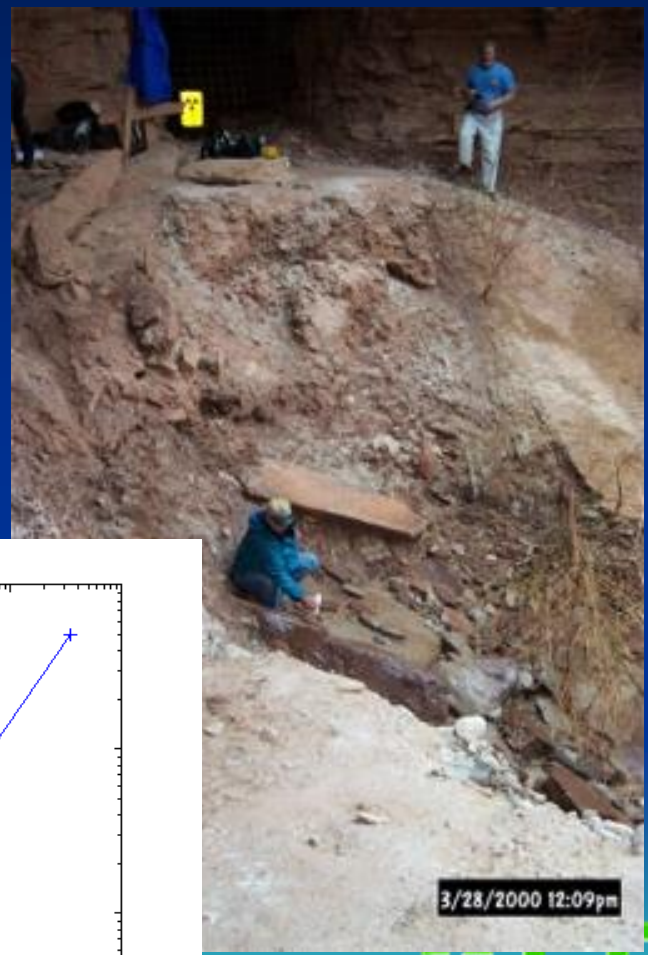
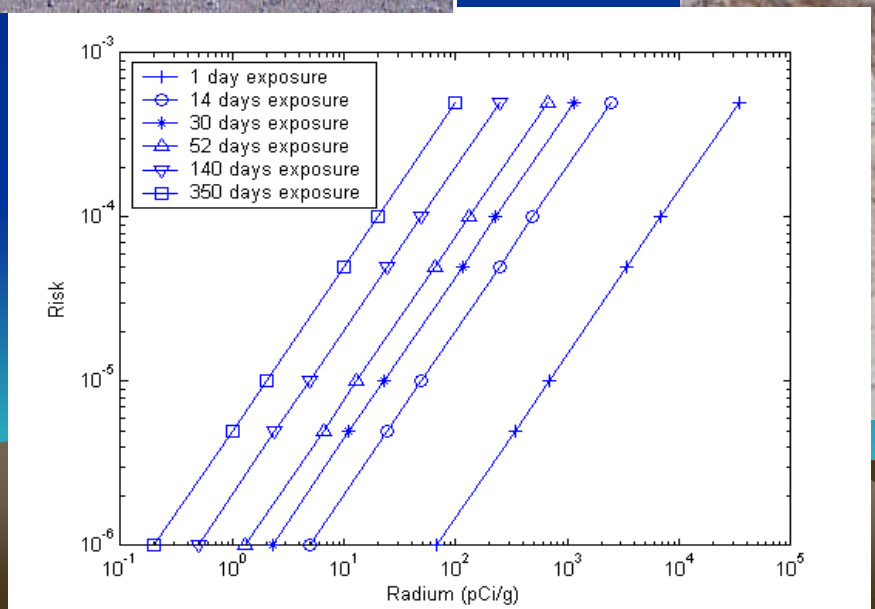
Modeling Scenarios – Recreational and Workers





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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

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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

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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.**

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And More -- Radionuclide MCLs

- Standards

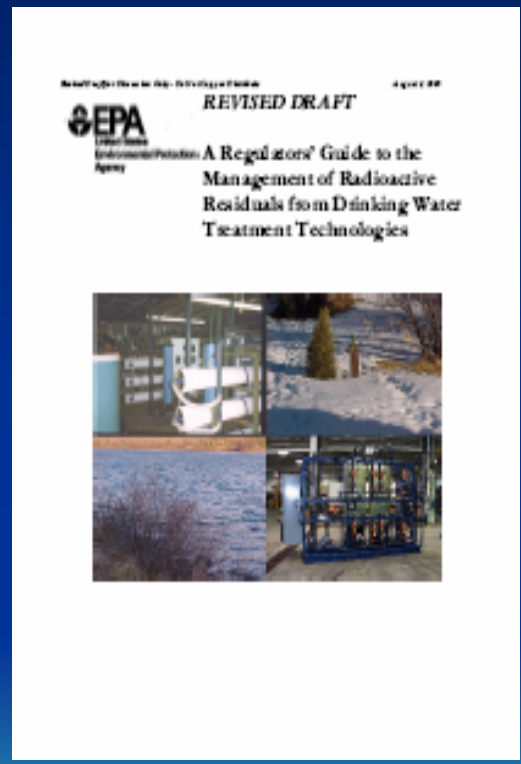
Radionuclide	Level
Combined radium-226 and 228	5 pCi/L
Gross alpha particle activity (excluding radon and uranium	15 pCi/L
Beta particle and photon radioactivity	4 mrem/year
Uranium	30 ug/L

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**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A Regulators' Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies

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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**

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And More -- Radionuclide MCLs

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

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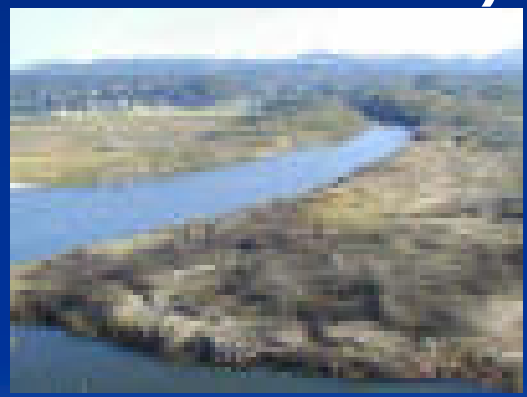
And More -- Radionuclide MCLs

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



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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**

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