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Uranium Mining in Virginia – Potential Environmental Effects
The National Academies Report

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Protecting Health, Saving Lives—*Millions at a Time*

Snapshot of this Presentation

- (Brief) Overview of NAS report
 - Statement of Task
 - Committee Process and Public Engagement
- Caveats and Disclosures
- Key Background Information
- Environmental Considerations
 - Human Health Effects
 - Ecological/Environmental Effects
 - Laws and regulations
- Best Practices
- Conclusion



(Brief) Overview of NAS report



NAS Statement of Task (SOT)

- Full statement of task and committee members at www.nationalacademies.org (search “uranium virginia”)
- Key points:
 - examine scientific, technical, environmental, human health and safety, and regulatory aspects of uranium mining, milling and processing as they relate to the Commonwealth of Virginia
 - for the purpose of assisting the Commonwealth to determine whether uranium mining, milling and processing can be undertaken in a manner that safeguards the environment, natural and historic resources, agricultural lands, and the health and well-being of its citizens.
- Excluded from SOT
 - Site specific assessments
 - Conclusion regarding whether uranium mining should/should not be undertaken in Virginia



Committee Process and Public Engagement

- Meetings
 - 11 months, 7 meetings, 19+ full days
 - All meetings (except the last one) had open and closed sessions
 - 44 experts provided testimony
 - Extensive committee deliberation at and between meetings
- Public Engagement (pre-release)
 - 2 Town Hall sessions to take testimony from public
 - Approximately 150 people spoke
- Public Engagement (post-release)
 - Briefing before the Virginia Legislature's Coal and Energy Commission
 - 5 Public hearings throughout the Commonwealth



Caveats and Disclosures

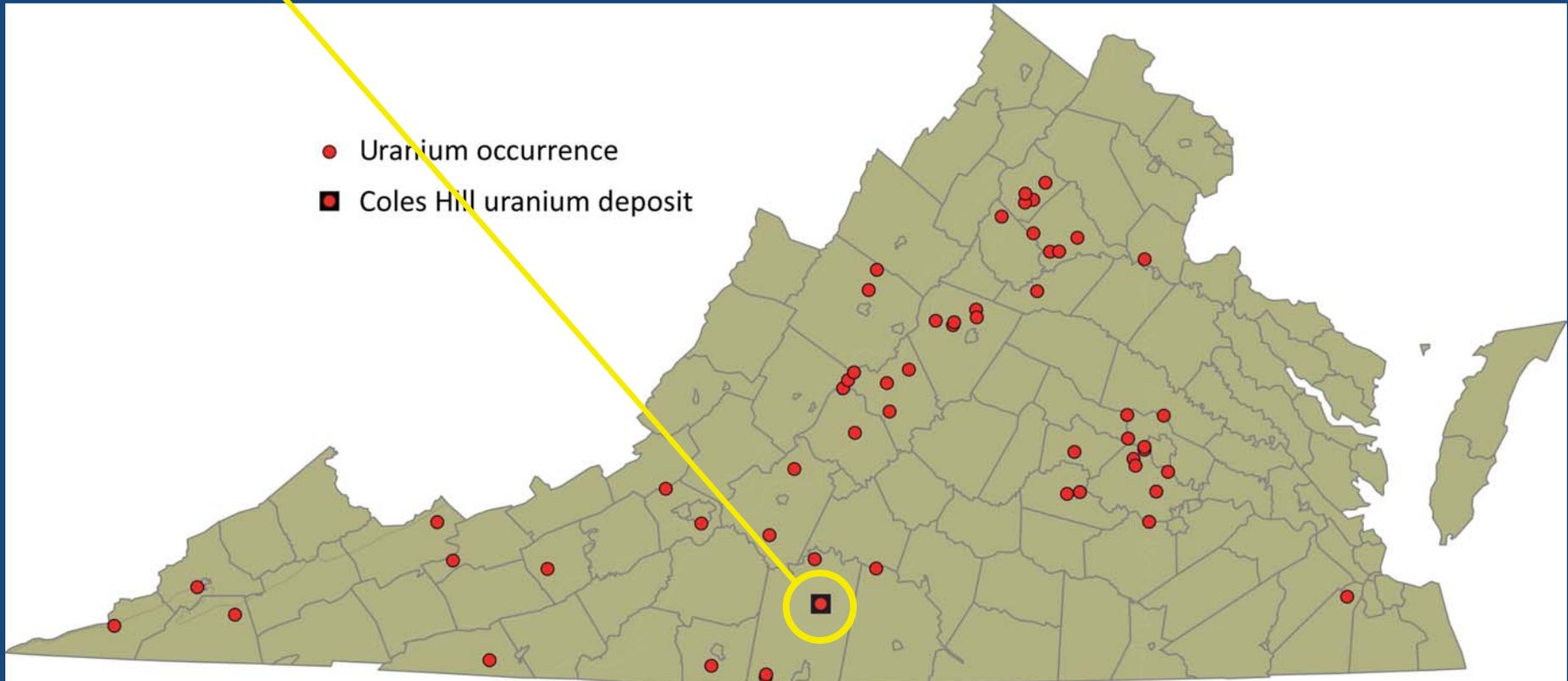


Key Background Information

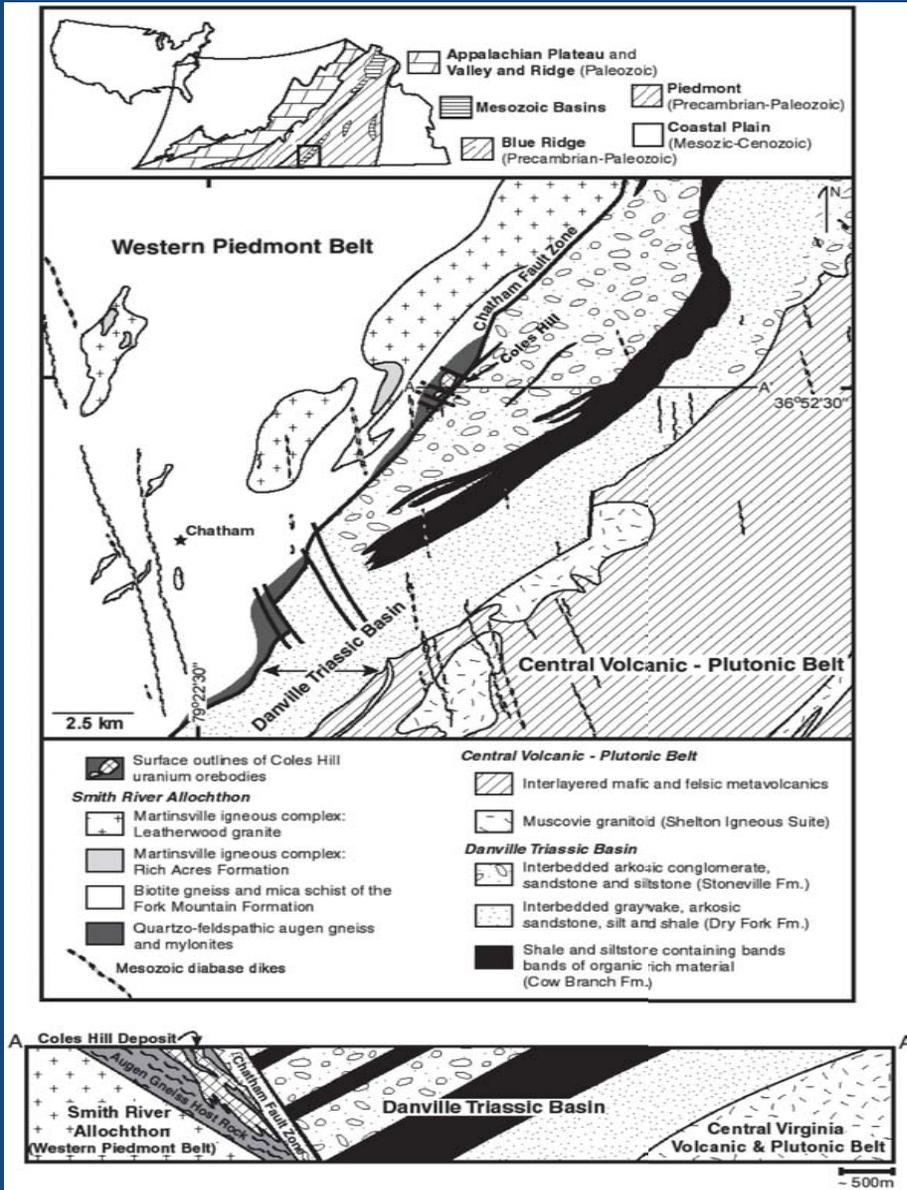


Uranium Occurrences in Virginia (figure 3)

Coles Hill Site



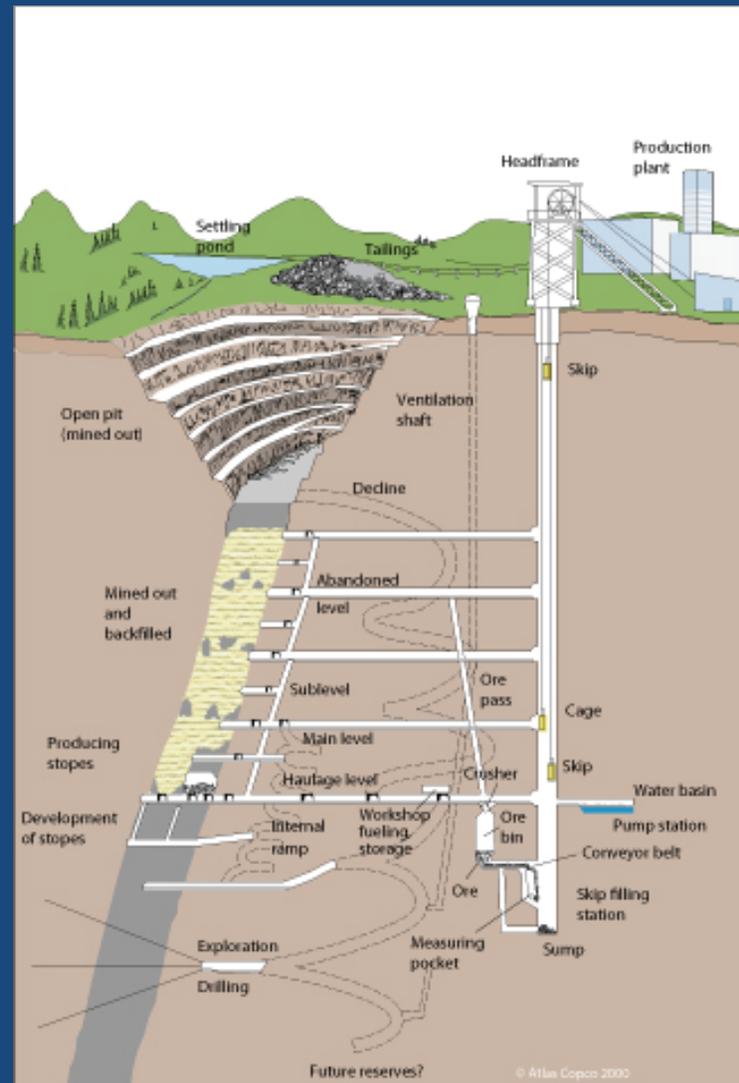
Coles Hill Site, Pittsylvania County Virginia (figure 3.13)



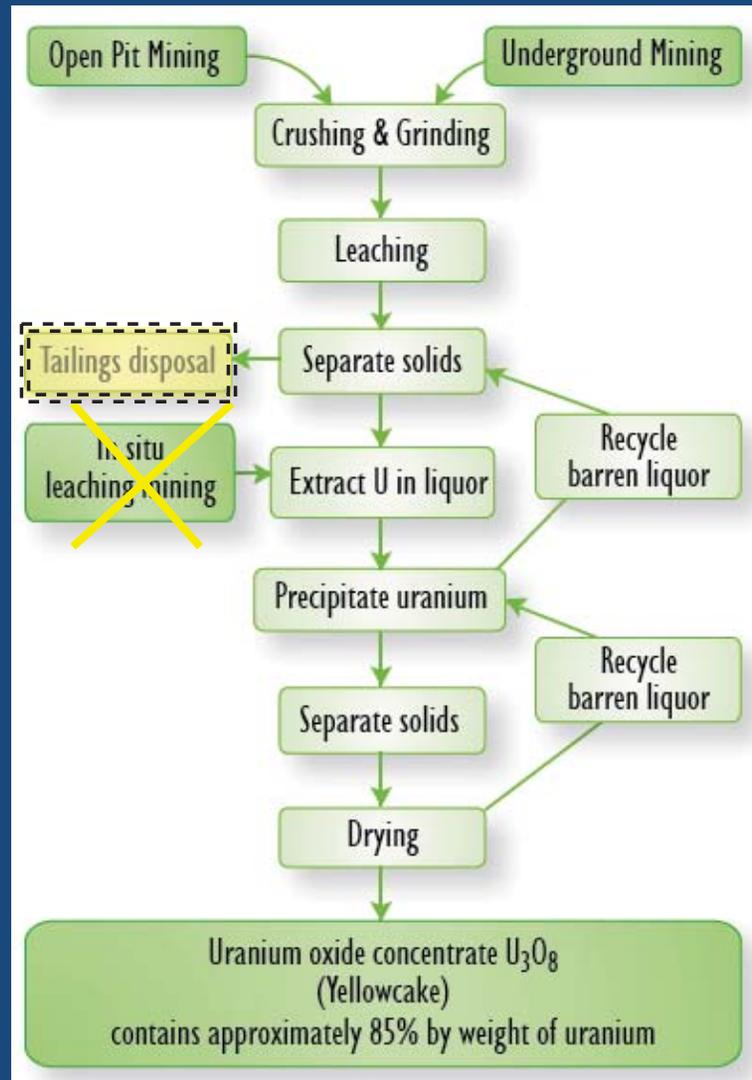
Only deposits at the Coles Hill site seem to be potentially economically viable at present.



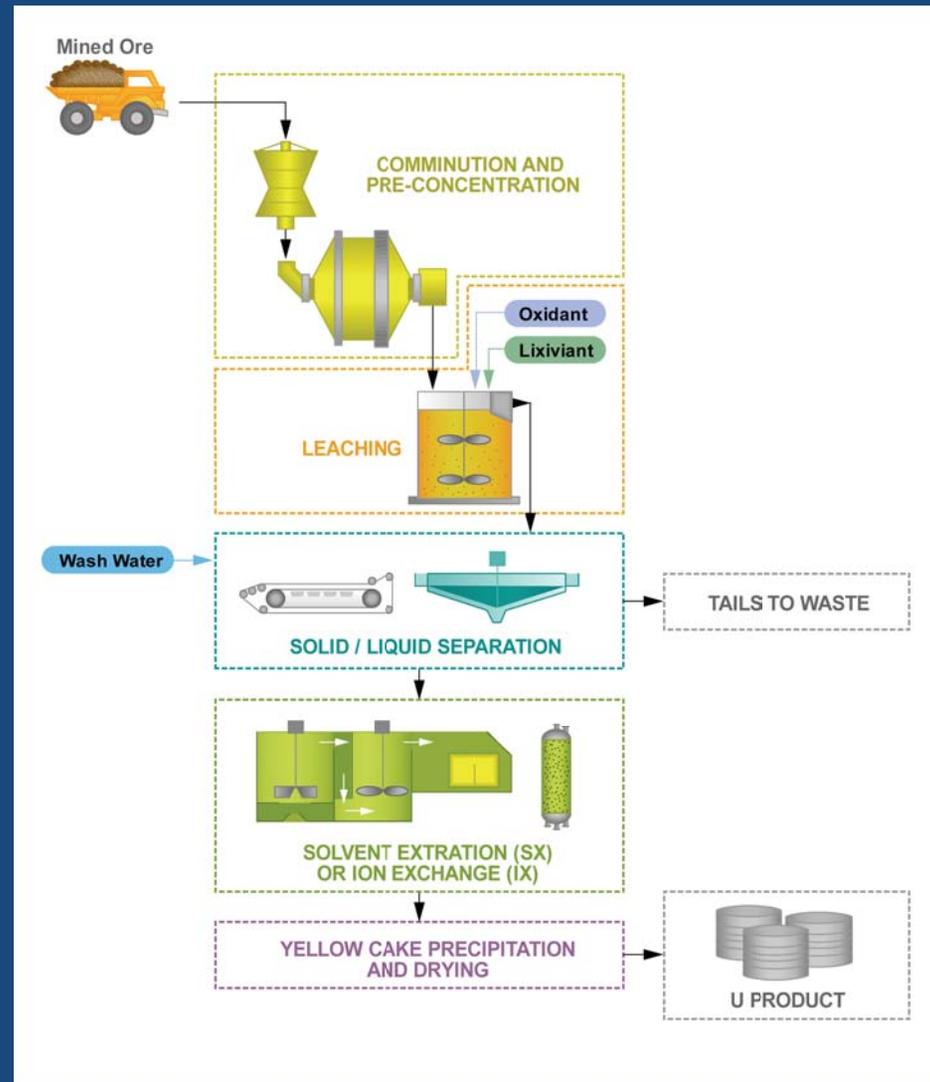
Combined Underground and Open Pit Mine (figure 4.1)



Uranium Processing Flow Diagram (figure 4.7)



Conventional Agitated Leach Process (figure 4.9)



Environmental Considerations

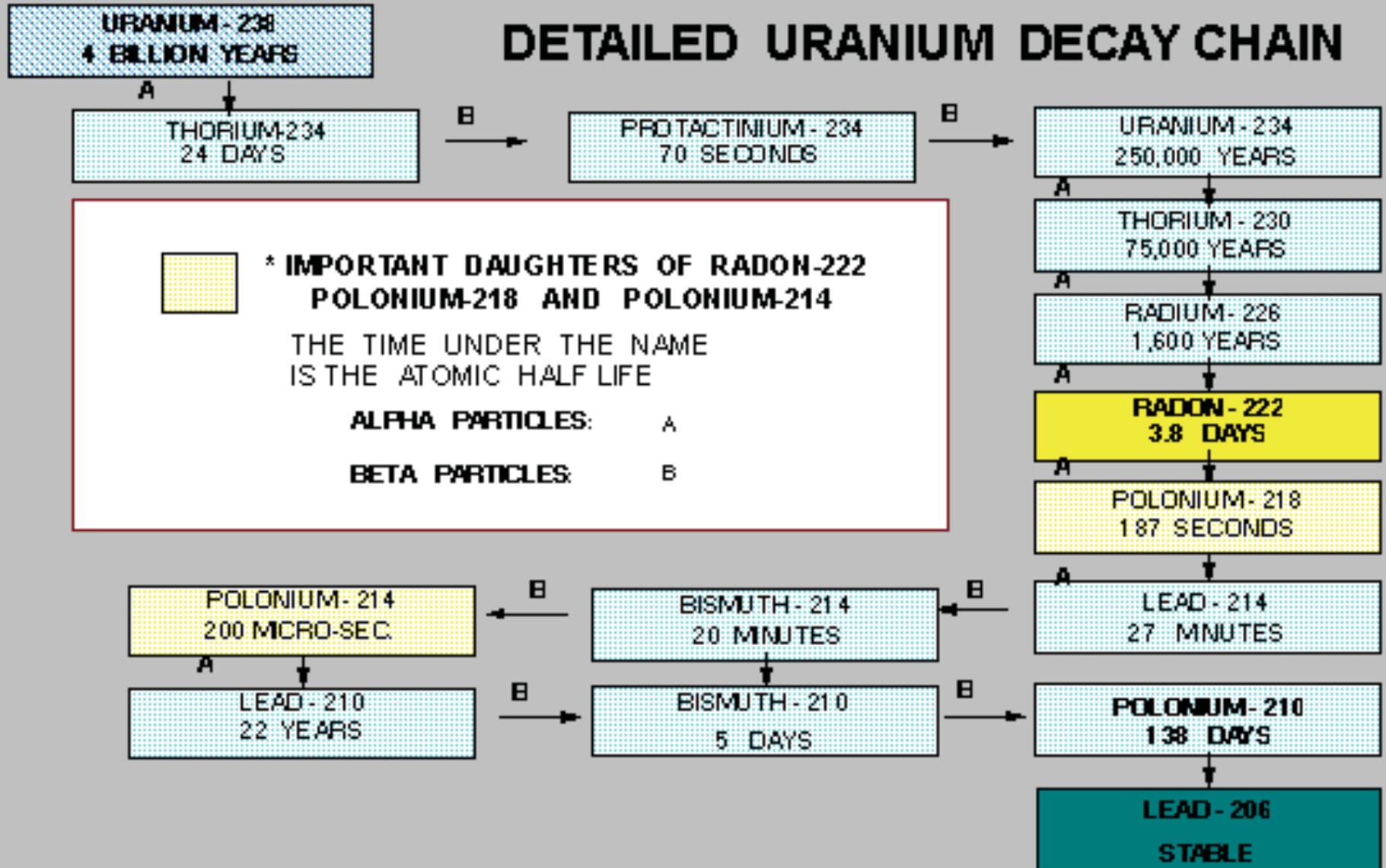


Human Health Effects

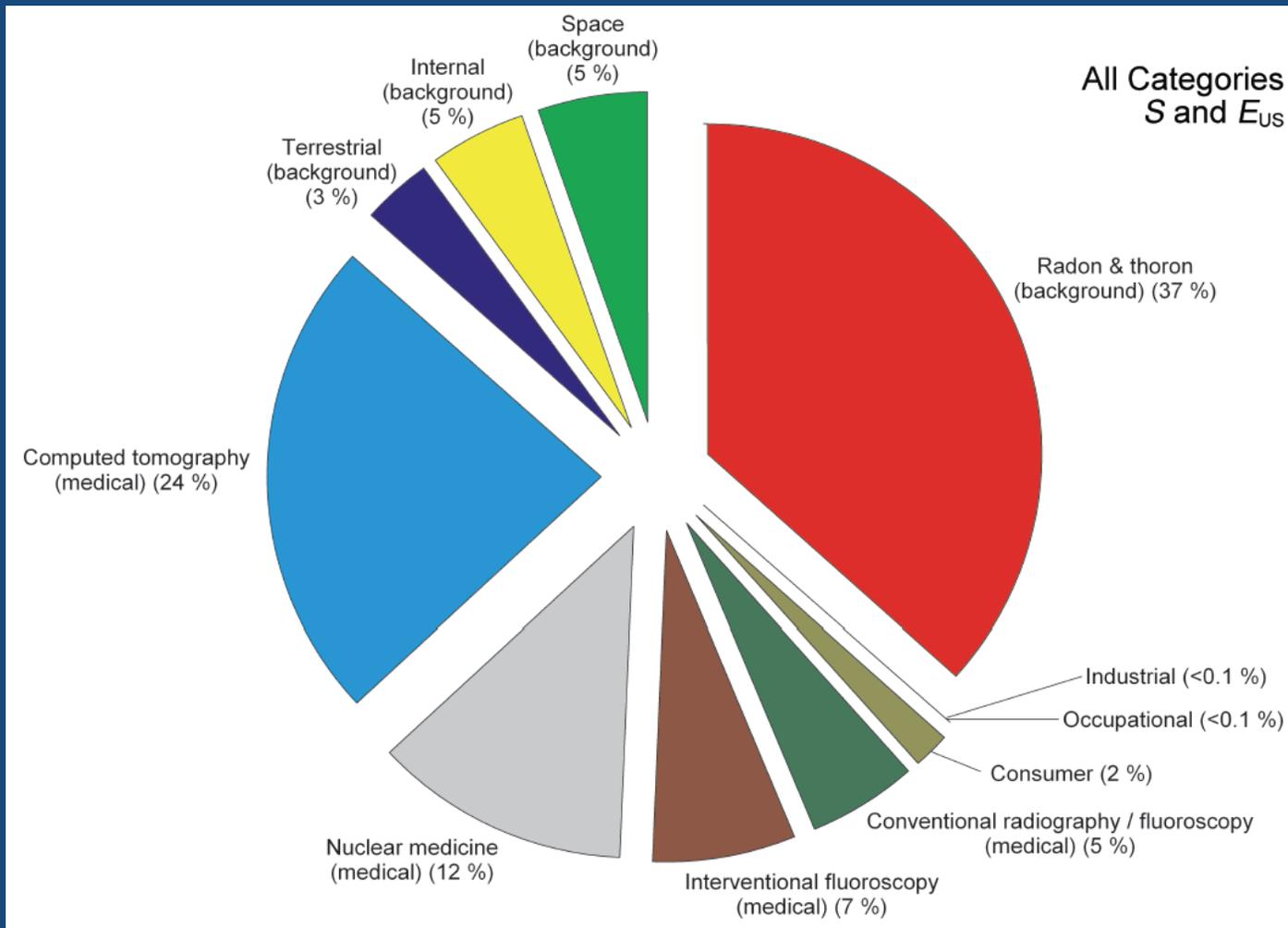
- Health risk for workers
 - Non-radiation risks are similar to construction and mining
 - Work-related physical trauma (including electrical injury)
 - Protracted radon exposure is largest radiological risk
 - Silica dust and diesel exhaust exposure create/exacerbate lung cancer risk
- Off-site health risks to communities
 - Tailings risks – radiation and chemical exposure potential
 - Radiation decay products provide a constant source of radiation for thousands of years (beyond our regulatory experience)
 - Site specific conditions and project management are critical



DETAILED URANIUM DECAY CHAIN



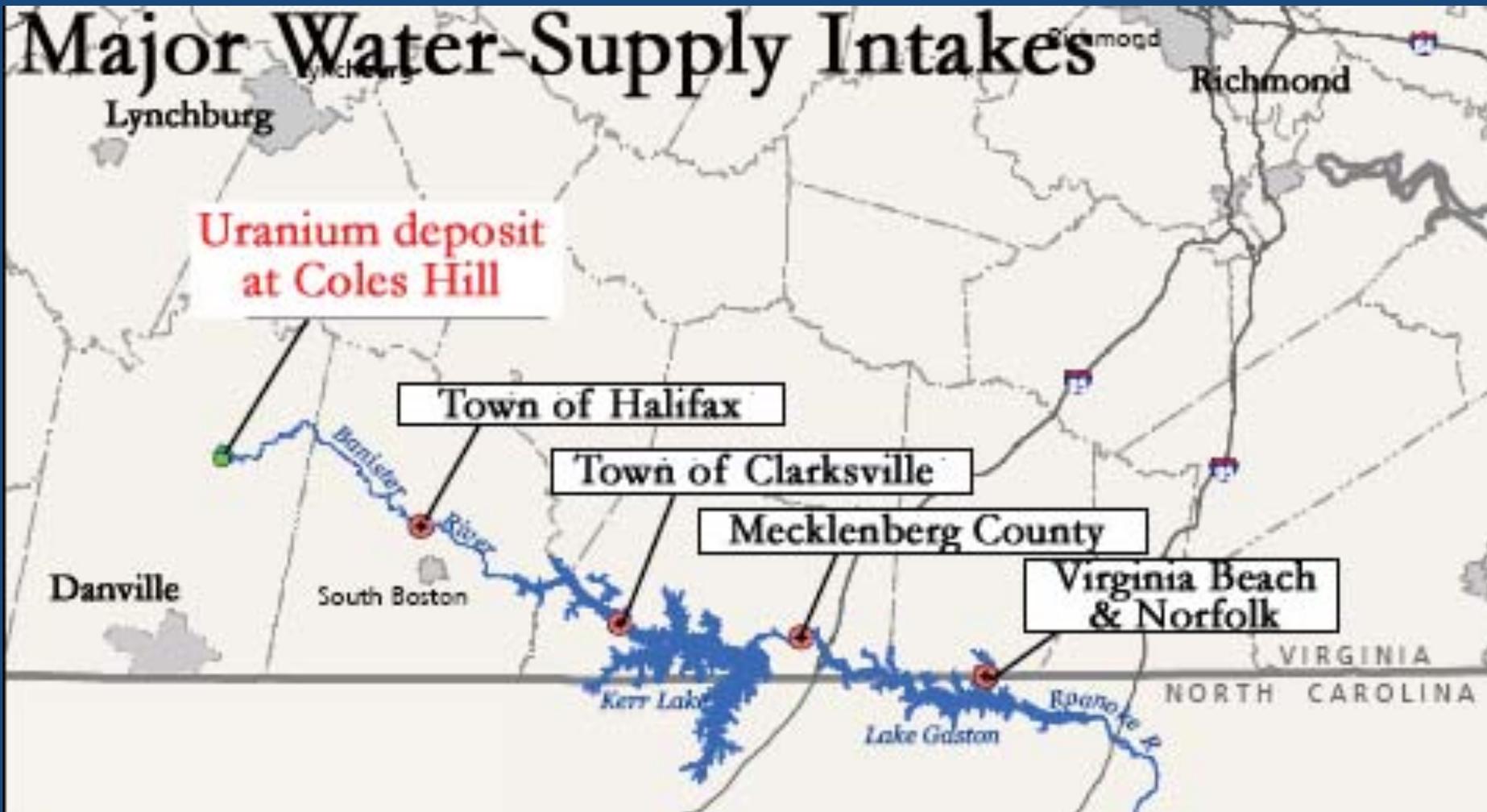
Contribution to Radiation Dose (Total Effective Dose Equivalent) per person (Figure 4)



Ecological and Environmental Effects

- Impact on water
 - Surface water quantity and quality
 - Ground water quantity and quality
- Tailings disposal sites
 - Potential sources of contamination for thousands of years
 - Long term risks are poorly defined
- Extreme natural events and failures in management could create significant potential risks
 - Hurricanes, earthquakes, intense rainfall, drought
 - Poorly designed facilities and waste management errors
- Applying best practices, near to moderate term effects should be substantially reduced
- There is limited data to confirm long-term effectiveness of best practices





Source: Virginia League of Conservation Voters



Laws and Regulations

- Patchwork of federal and state laws and regulations cover mining, processing, reclamation, long-term stewardship
- Virginia has no experience regulating uranium mining and no existing regulatory structure specifically for uranium mining
- No federal law applies to mining on non-federal lands
 - State laws would cover mining activities
 - Federal environmental laws would cover air, water land contamination
 - Federal laws would cover worker health and safety
- US Government has only limited recent experience regulating conventional uranium processing and reclamation
- Federal agencies have limited experience applying laws and regulations in positive water balance situations
- Opportunities for meaningful public involvement are fragmented and limited.



US Uranium Mills and Plants, 1996 - 2011

Table 2. Number of uranium mills and plants producing uranium concentrate in the United States

Uranium Concentrate Processing Facilities	End of 1996	End of 1997	End of 1998	End of 1999	End of 2000	End of 2001	End of 2002	End of 2003	End of 2004	End of 2005	End of 2006	End of 2007	End of 2008	End of 2009	End of 2010	4th Quarter 2011
Mills - conventional milling ¹	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1
Mills - other operations ²	2	3	2	2	2	1	1	0	0	1	1	1	0	1	0	0
In-Situ-Leach Plants ³	5	6	6	4	3	3	2	2	3	3	5	5	6	3	4	5
Byproduct Recovery Plants ⁴	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	9	11	9	7	6	4	3	2	3	4	6	6	7	4	5	6

¹ Milling uranium-bearing ore.

² Not milling ore, but producing uranium concentrate from other (non-ore) materials.

³ Not including in-situ-leach plants that only produced uranium concentrate from restoration.

⁴ Uranium concentrate as a byproduct from phosphate production.

Source: U.S. Energy Information Administration: Form EIA-851A and Form EIA-851Q, "Domestic Uranium Production Report."



Best Practices

- Three overarching best practices
 - Require a complete life cycle approach, front-loaded during project planning
 - Use expertise and experience of professionals familiar with internationally accepted best practices
 - Engage in meaningful and timely public participation throughout the life cycle of the project
- Other relevant best practices
 - Apply ALARA to enhance regulations
 - Create a proactive, well designed and executed monitoring program, and make it available to the public
 - Use personal dosimetry for workers and a national radiation dose registry
 - Adopt NIOSH recommended exposure limits





NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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NRC ISSUES FINAL SAFETY CULTURE POLICY STATEMENT

“Safety culture refers to an organization’s collective commitment, by leaders and individuals, to emphasize safety as an overriding priority to competing goals and other considerations to ensure protection of people and the environment.”

Conclusion

- If the Commonwealth of Virginia rescinds the existing moratorium on uranium mining, there are steep hurdles to be surmounted before mining and/or processing could be established within a regulatory environment that is appropriately protective of the health and safety of workers, the public, and the environment.
- There is only limited experience with modern underground and open pit uranium mining and processing practices in the wider United States, and no such experience in Virginia.
- At the same time, there exist internationally accepted best practices, founded on principles of openness, transparency, and public involvement in oversight and decision-making, that could provide a starting point for the Commonwealth of Virginia were it to decide that the moratorium should be lifted.
- After extensive scientific and technical briefings, substantial public input, reviewing numerous documents, and extensive deliberations, the committee is convinced that the adoption and rigorous implementation of such practices would be necessary if uranium mining, processing, and reclamation were to be undertaken in the Commonwealth of Virginia.





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Thank you !
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