Evaluation of Potential Impacts of Uranium Mining on Drinking Water Sources in the Roanoke River Basin

Assessment Approach

March 31, 2010

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Background

- **Uranium in Virginia**
  - Leases were issued for uranium mining in the past
  - Coles Hill site in Pittsylvania County may have a large reserve
  - Uranium reserves are located upstream of drinking water supplies
  - Communities are concerned that uranium mining may impact their drinking water sources

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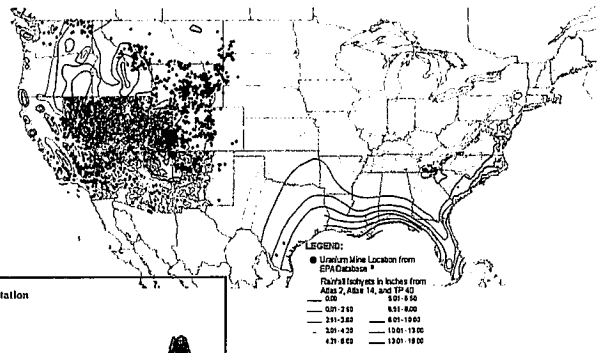
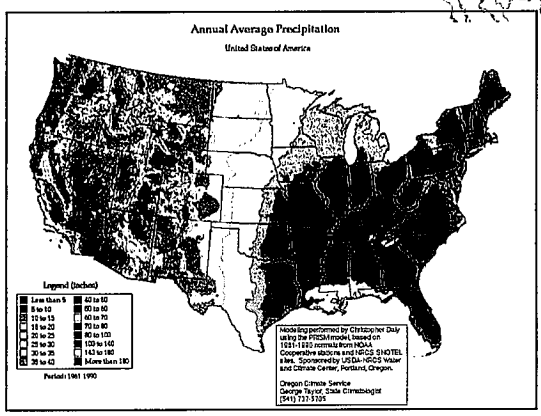
Why the concern?





Climate and landscape features in Virginia produce much greater precipitation than western US.

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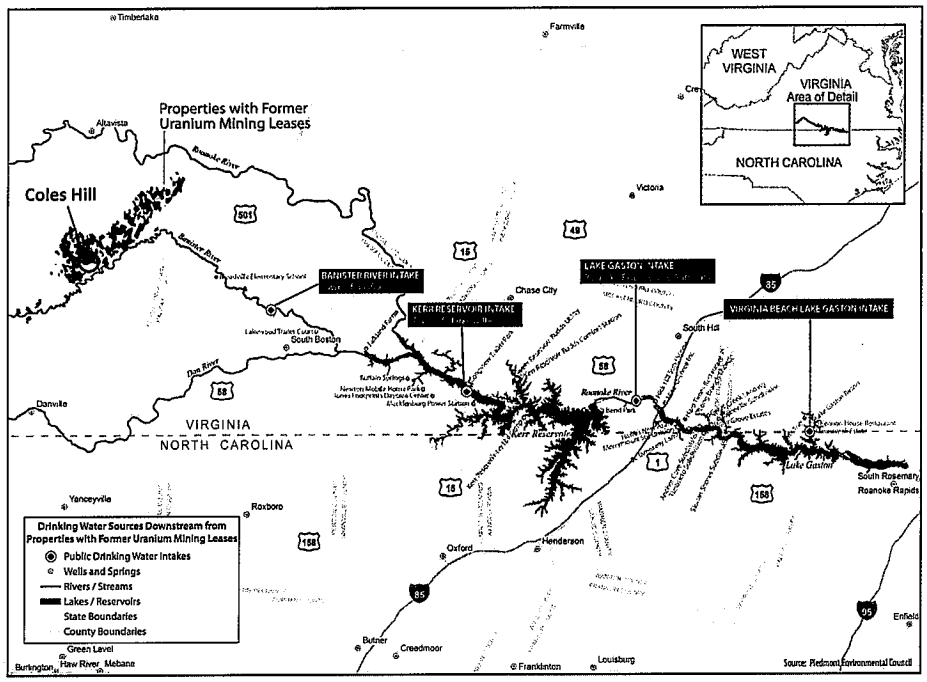
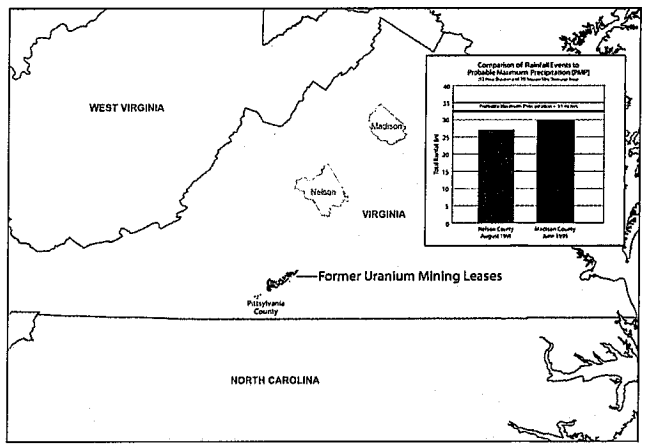


Probable Maximum Precipitation Events in Virginia

- Nelson County – August 1969
  - 27 – 31 inches in 8-hours
- Madison County – June 1995
  - 30 inches in 14 hours



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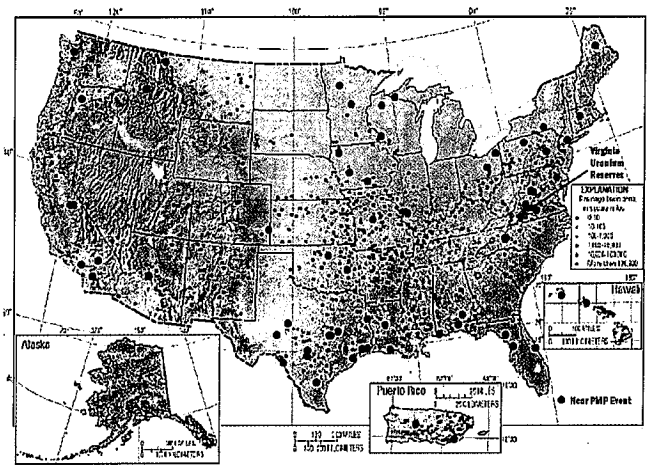
Extreme Flooding and PMP Events

Average stream flow in VA – 1 cfs per square mi

USGS Extreme Floods – 50 to 300 cfs per square mi



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Project Description

- Phase I Assessment:
  - Assume a PMP-type catastrophe and sediment release
  - Estimate of contaminated sediment to reach Kerr Reservoir
  - Assess potential increase in background radiation levels in Kerr Reservoir
- Phase II Assessment:
  - Detailed analysis based on Phase I results (if deemed necessary).

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Project Description

- Phase I Assessment:
  - Banister and Roanoke Rivers will be modeled
  - One-dimensional numerical model will be used
  - CCHE1D: National Center for Computational Hydroscience and Engineering (NCCHE) at the University of Mississippi
  - CCHE1D simulates unsteady flows and sediment transport in dendritic channel networks
  - CCHE1D also simulates transport and fate of radionuclide's

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Project Description

- Phase I Assessment:
  - A number of containment failure scenarios will be run to represent:
    - Release quantities - small and large
    - Release durations – short and long
  - HEC-RAS model will also be run to address model uncertainty in sediment transport
  - ***Model will assume certain amounts of sediment release from hypothetical catastrophe***
  - Phase 1 to be complete in Fall 2010

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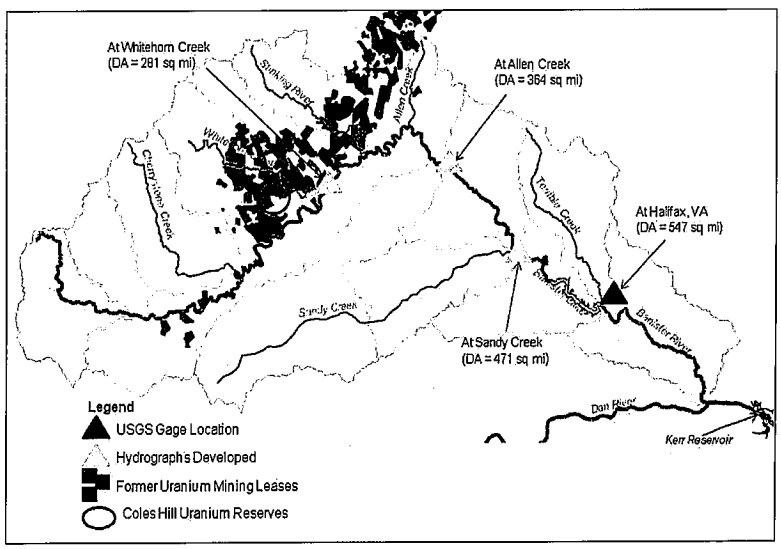
Banister River Watershed



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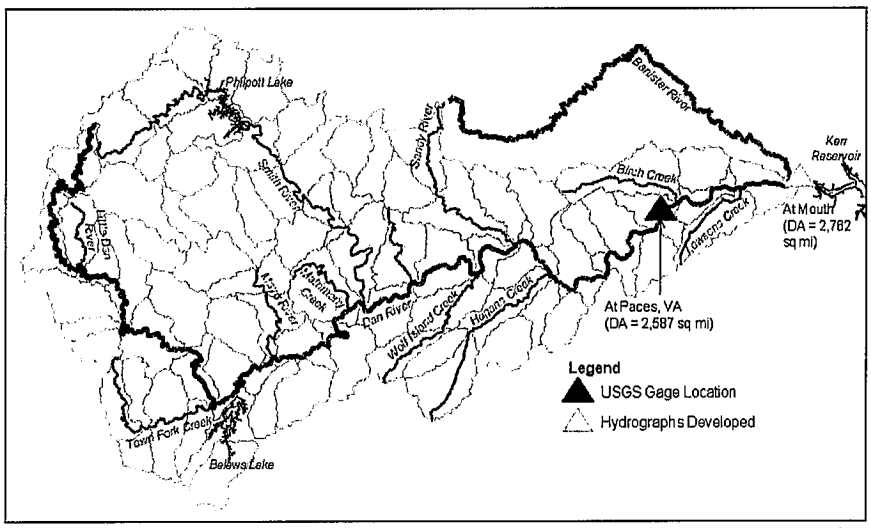
Dan River Watershed



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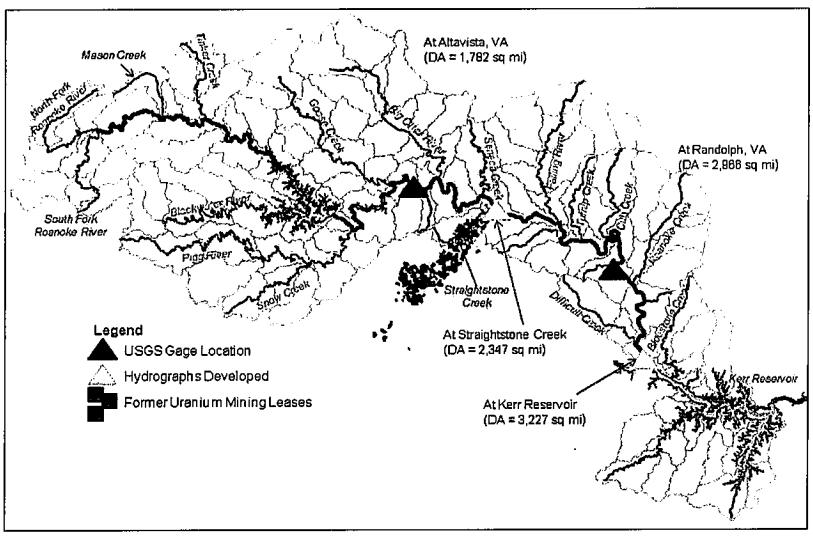
Roanoke River Watershed



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One Dimensional Modeling Objectives

Following a hypothetical PMP-event which releases certain quantities of mill tailings and effluents into the Banister or Roanoke Rivers:

What amount of radionuclide-contaminated sediment and water might reach Kerr Reservoir?

- **In the short term** (i.e. during the high-flow caused by the extreme precipitation event that triggered the failure) and
- **In the long term** (during subsequent high-flow events of lesser magnitude, but higher frequency)

What would be the potential increase in background radiation levels and other contaminants levels in Kerr Reservoir?

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SENSITIVITY ANALYSIS

Modeling parameters:

- Manning's roughness,
- adaptation coefficient,
- sediment transport capacity formula, etc.

Meteorological Parameters:

- Two different extreme events (500-yr & 100-yr storm events will be considered for short-term impact simulations)
- Small and large released tailings
- Short and long duration releases

This sensitivity analysis will provide information about the relative impact of each variable on the results.

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UNCERTAINTY ANALYSIS

Three variables will be considered:

- Volume of the sediment released
- Initial radioactivity level of the tailings and the effluents
- The distribution coefficient, K_d.

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Independent Expert Review Panel

Specialized in key disciplines:

- Uranium Milling/Disposal of Milling Waste/Geotechnical
- Surface/Sub-Surface Water Contamination
- Sediment Transport, Unsteady Hydrodynamic Modeling
- Hydrology
- Water Chemistry/Treatment

Assist in development of the approach for the Phase 1

Review adequacy of data collected, critique the assumptions and the Phase 1 assessment design

Review, Critique and Evaluate Phase 1 report and conclusions

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