Uranium Mining Impact Study

City of Virginia Beach

Roanoke River Basin Bi-State Commission

25 July 2012

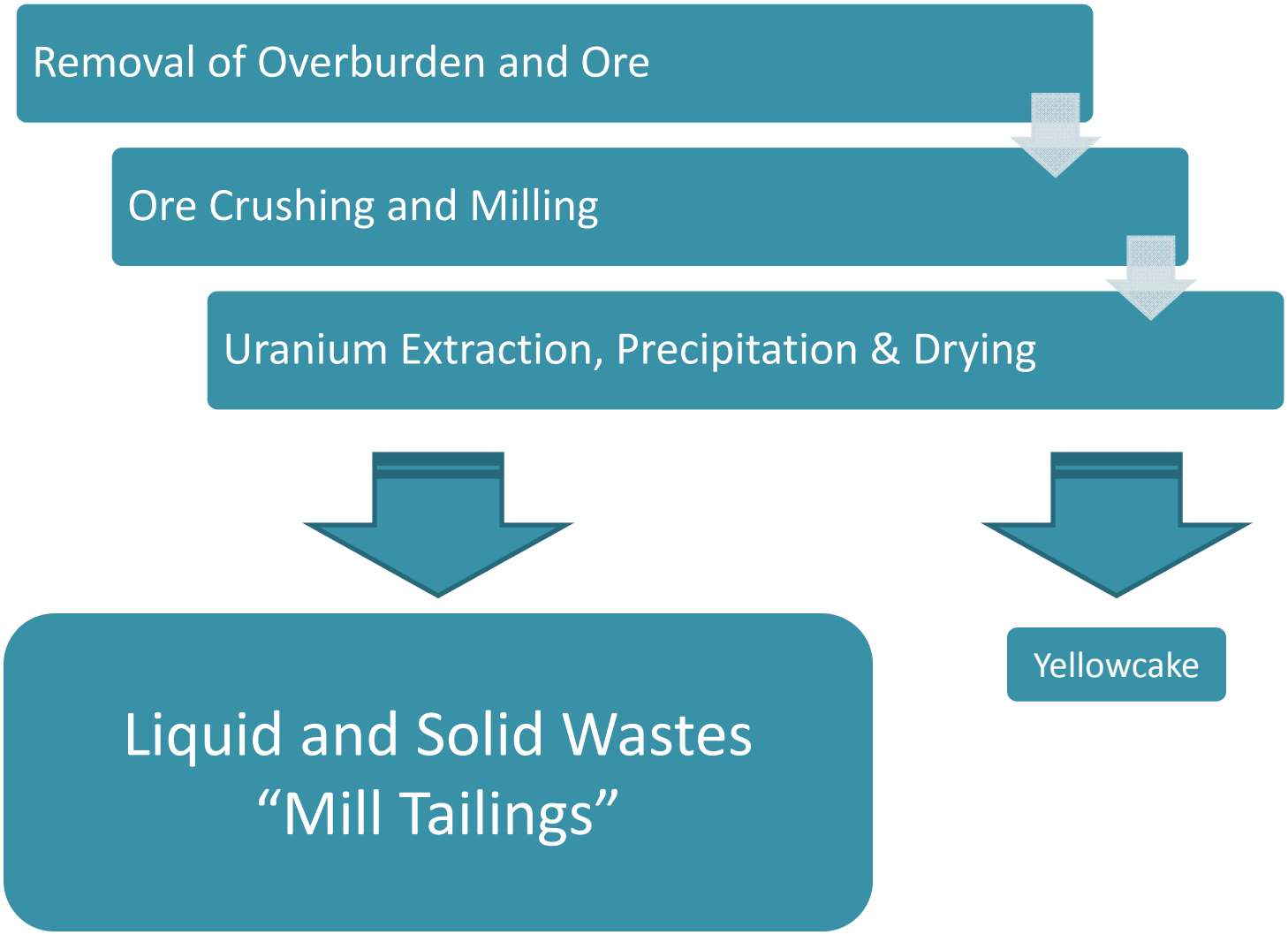
Concerns about Uranium Mining at Coles Hill

- Proposed mining location is upstream of Lake Gaston, a water source for Virginia Beach
- Refining activities will yield large amounts of radioactive and toxic waste material (tailings) that have to be stored on-site
- A catastrophic failure of a tailings confinement cell can result in contamination of the City of Virginia Beach's water supply

Study Area


Farmville
Crewe
Altavista
Blackstone
Coles Hill
Chase City
South Hill
South Boston
Danville
Lake Gaston Intake
Roanoke Rapids
Yanceyville
Roxboro
Henderson
Oxford

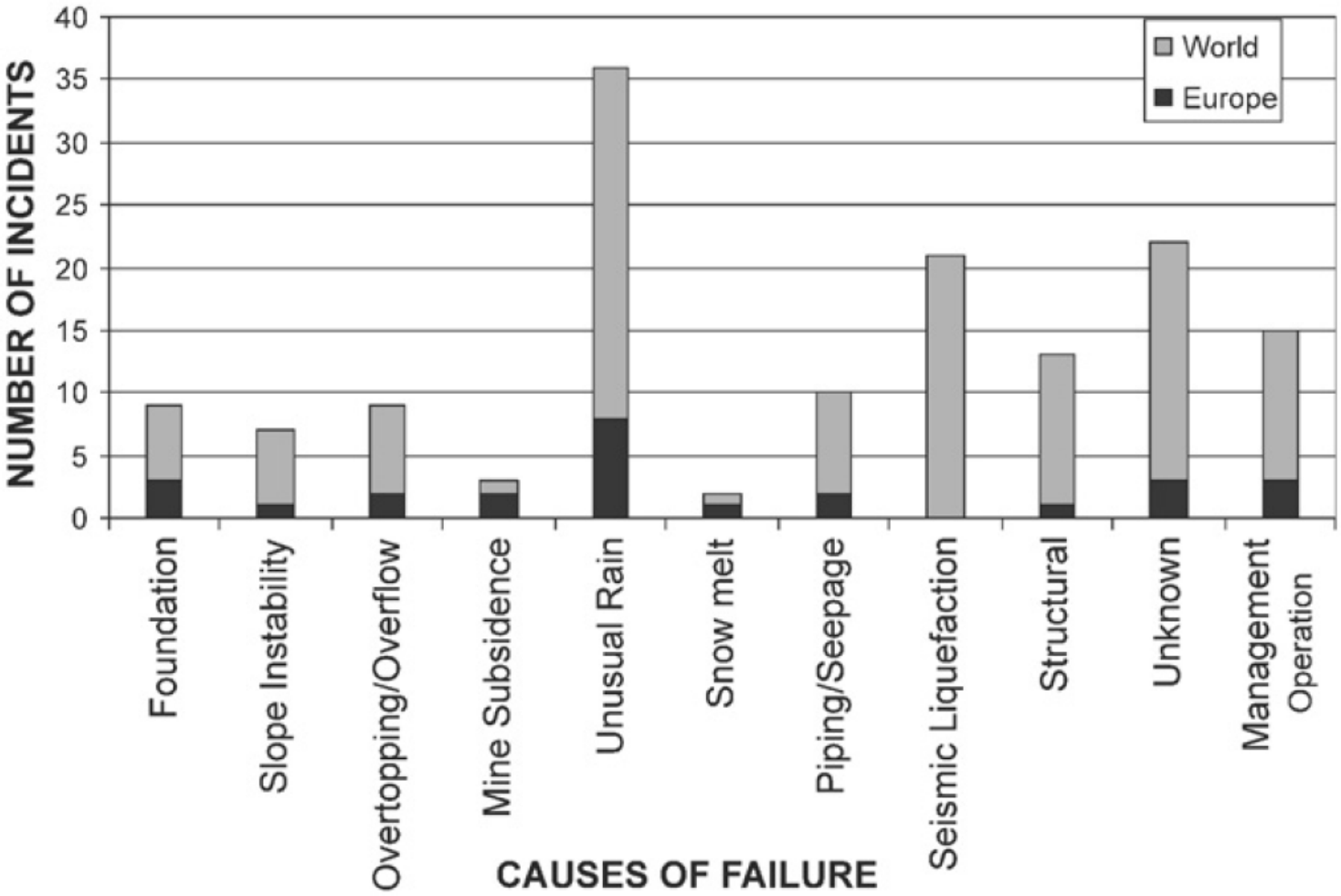
Uranium Mining & Milling



Current Mining Plan

- Foresees mining approximately 30 million tons of ore to yield 63 million pounds of U_3O_8
- Proposes deep shaft mining
- Calls for underground storage roughly half of the 22 million cubic yards of tailings
- Up to eight surface impoundments would hold the remainder of the tailings (up to 1.6 million pounds per cell, 40 acre maximum)

Causes of Tailing Cell Failures



Weather Hazards

- Precipitation in Virginia is 5 to 10 times greater than in traditional uranium mining areas in the arid West.
- Topography and climate in the region supports extreme rain events and flooding
- Region is highly susceptible to landslides

Hazard Scenario

- Containment failure due to extreme weather and flooding
- Discharge of mill tailings into the Roanoke watershed
- Transport of contaminated sediment and bulk water downstream to Kerr Lake and Lake Gaston

City of Virginia Beach Study

- Goal: Determine the impact of a discharge of mill tailings into Roanoke or Banister River on water quality downstream
- Provided the results of the Phase 1 Study to the National Academy of Sciences Committee on Uranium Mining.
- Phase 2 expanded the study area to Lake Gaston and focused on Coles Hill site.

Study Qualifiers

- The study simulated a rare event that regulations are supposed to prevent
- The model does not address the issue of whether there will be a catastrophe – it only simulates the outcome if one did occur

Modeling Approach

- 1-D and 2-D hydrodynamic river model
  - Simulate flow of water (1-D: Banister, Dan, Roanoke; 2-D: Kerr and Gaston)
- Sediment transport/morphological model
  - Simulate suspended and bed load transport of sediment and changes in bed elevation/cross-sections as a result of erosion/deposition
- Water quality model
  - Transport and fate of contaminants (U, Th, Ra)

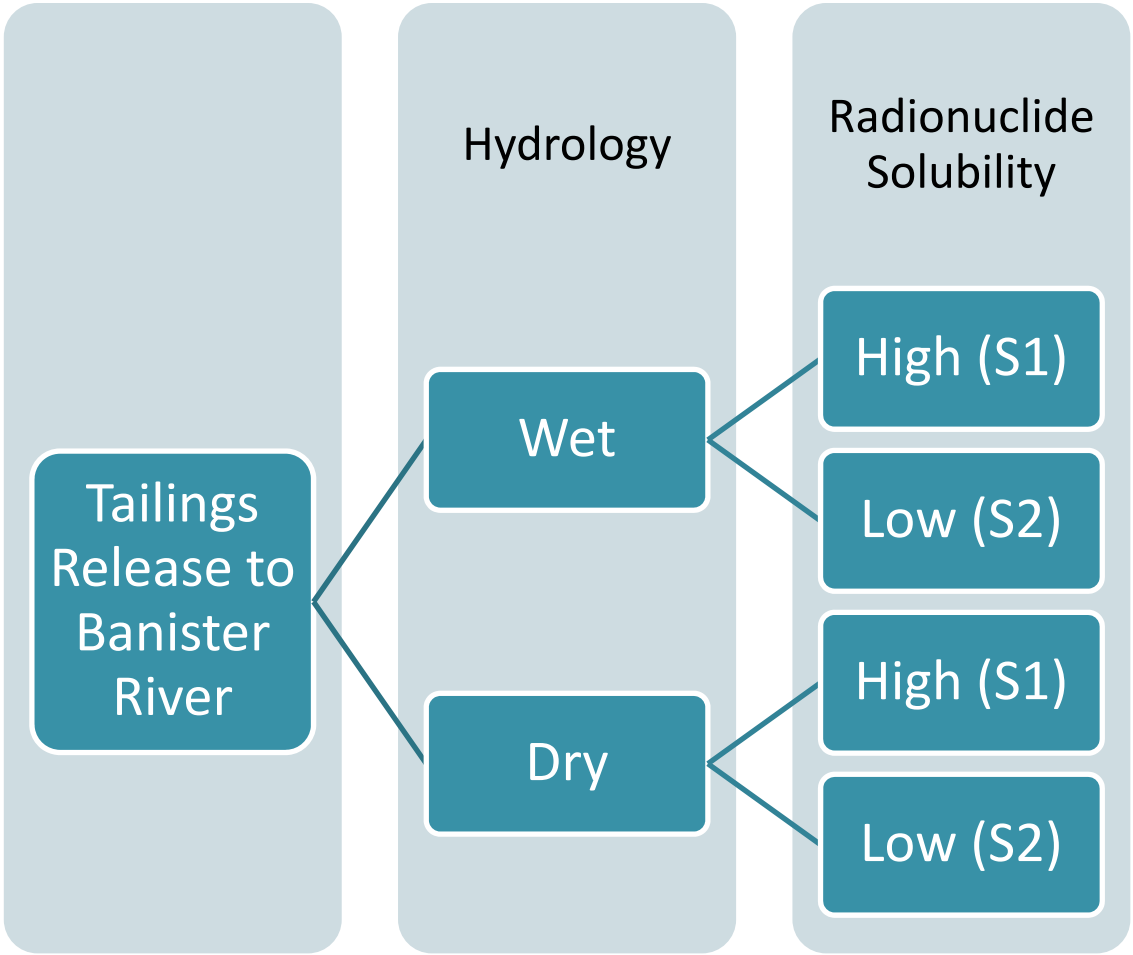
Other Model Characteristics

- Most recent river cross sections available from FEMA, VDOT, USACE were used
- Hydrology was simulated based on historical stream flow data. Tailings release to Banister River is followed by either
  - Wet period (Sep 1996 – Aug 1998)
  - Dry period (Jun 2001 – May 2003)

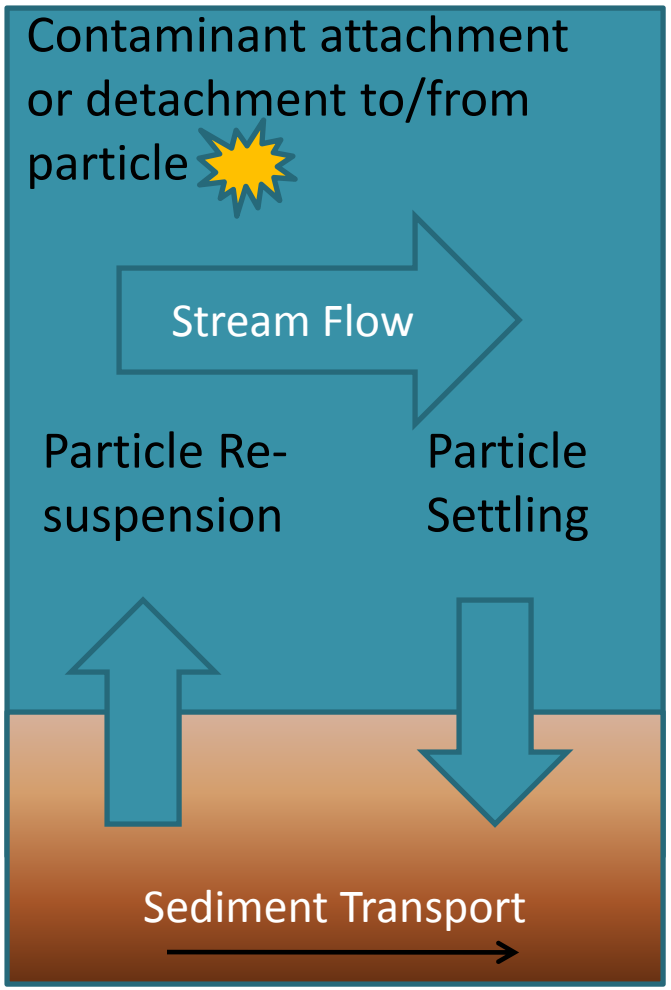
Other Model Characteristics

- Estimated tailings release volume based on current mining proposal and historical tailings dam failure data
  - Release of 720,000 yd^3 of tailings
- Assumed that the City's Lake Gaston pump station would not operate after tailings release

Scenarios in the Phase 2 Study



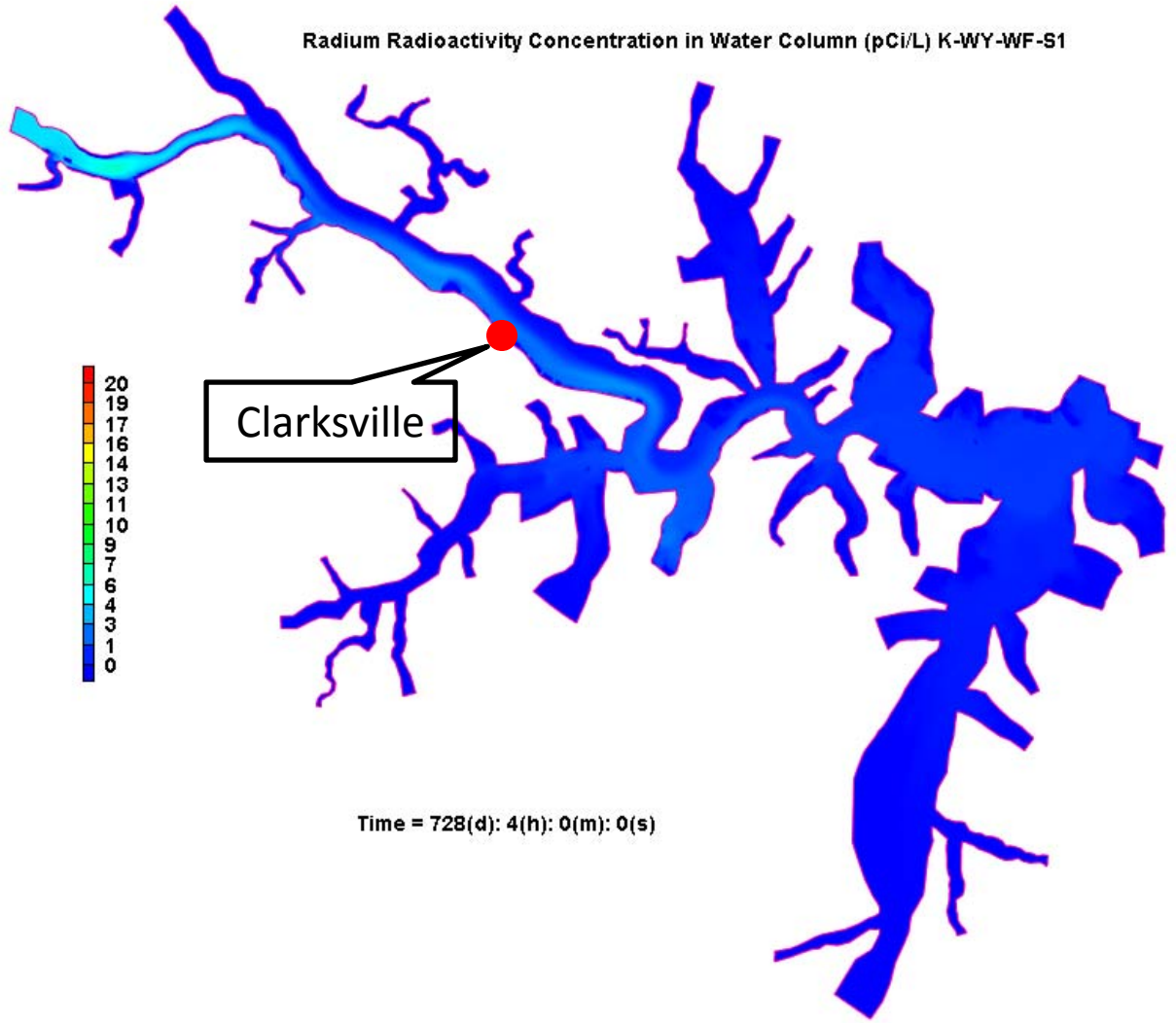
Contaminant Fate and Transport



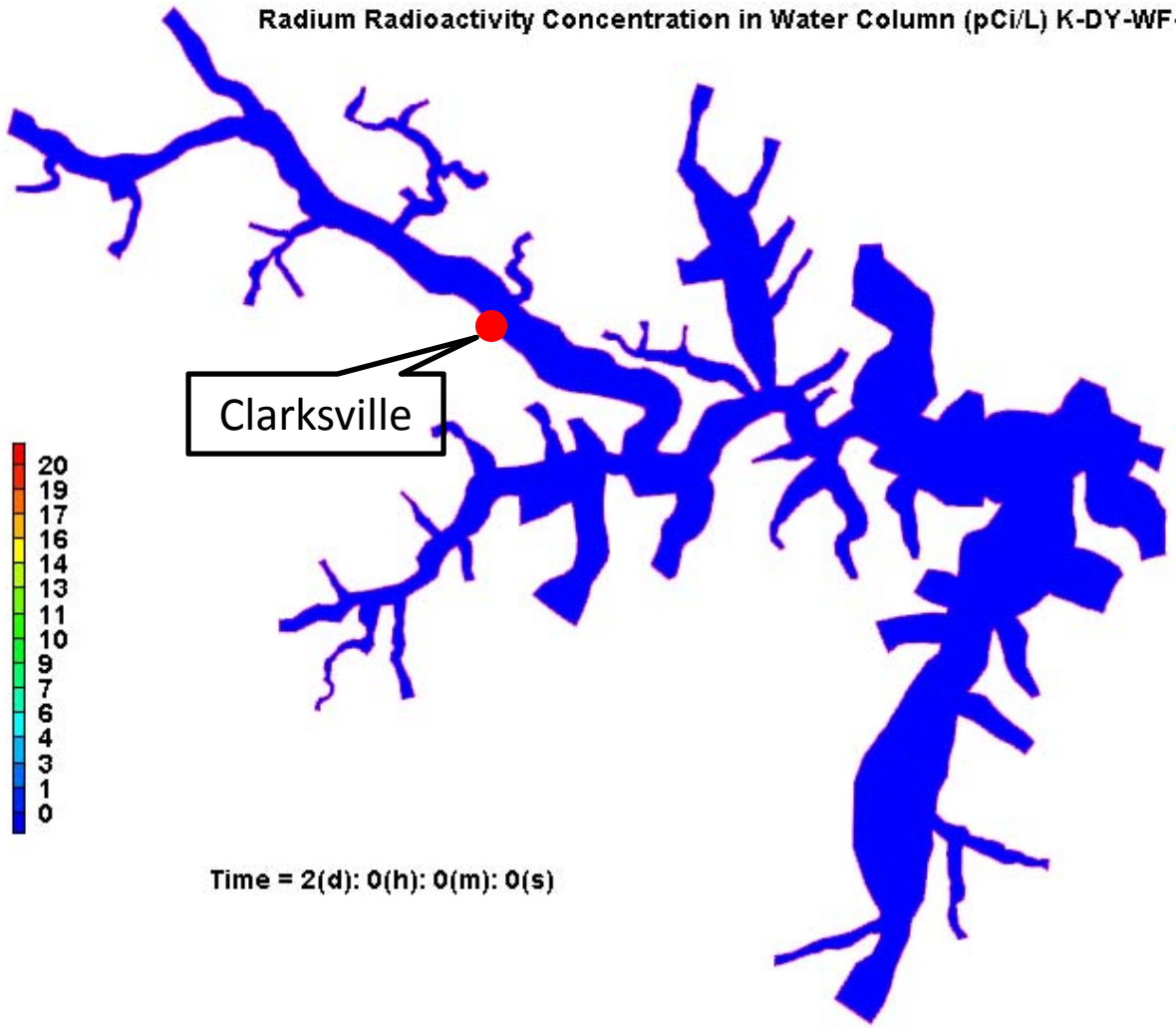
Water Column: Contains dissolved contaminants and contaminants attached to suspended particles

Sediments: Contains dissolved contaminants in pore water and contaminants attached to settled particles

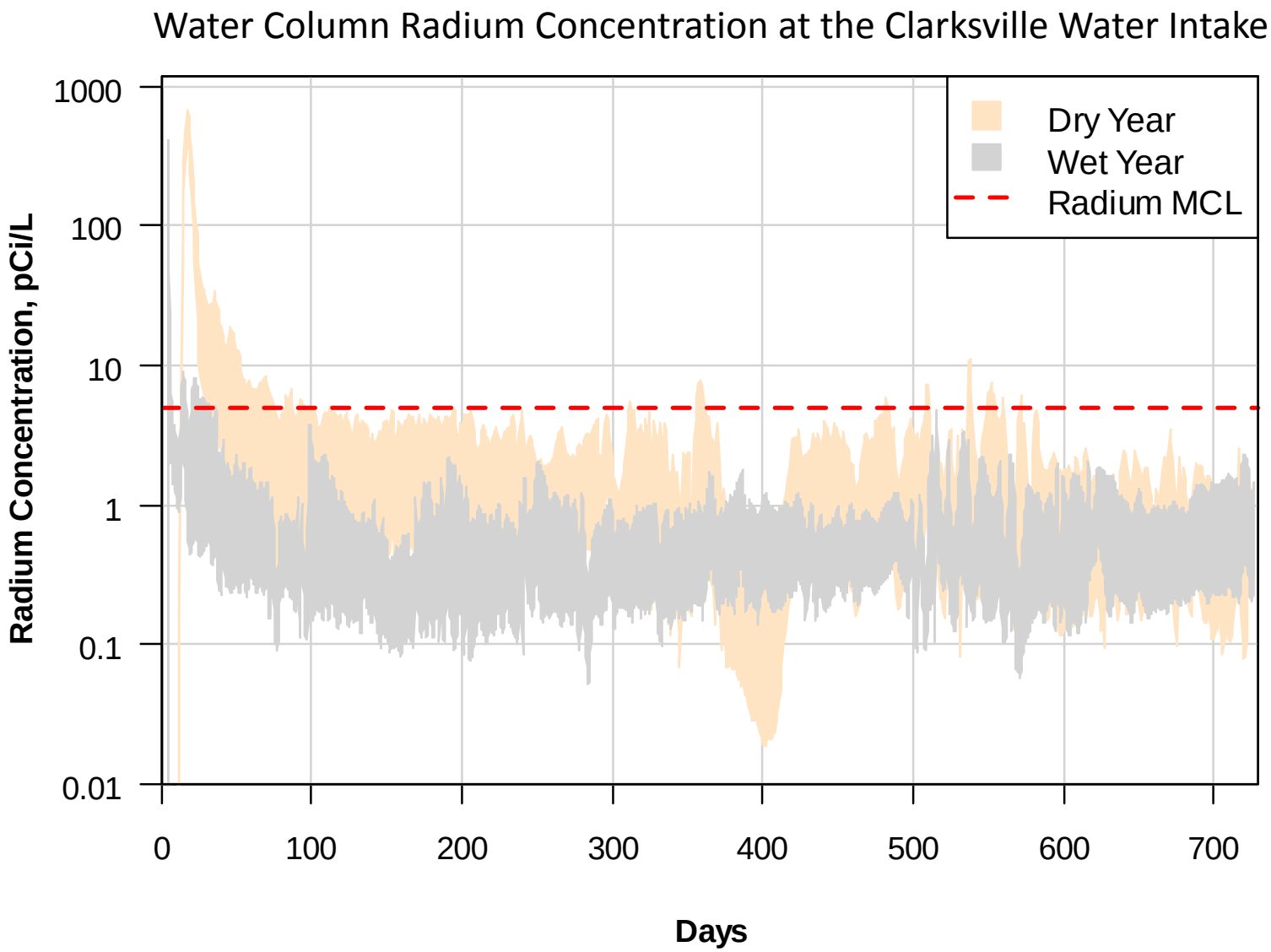
Impact to Kerr Lake
(Wet Year – High Solubility - Radium)



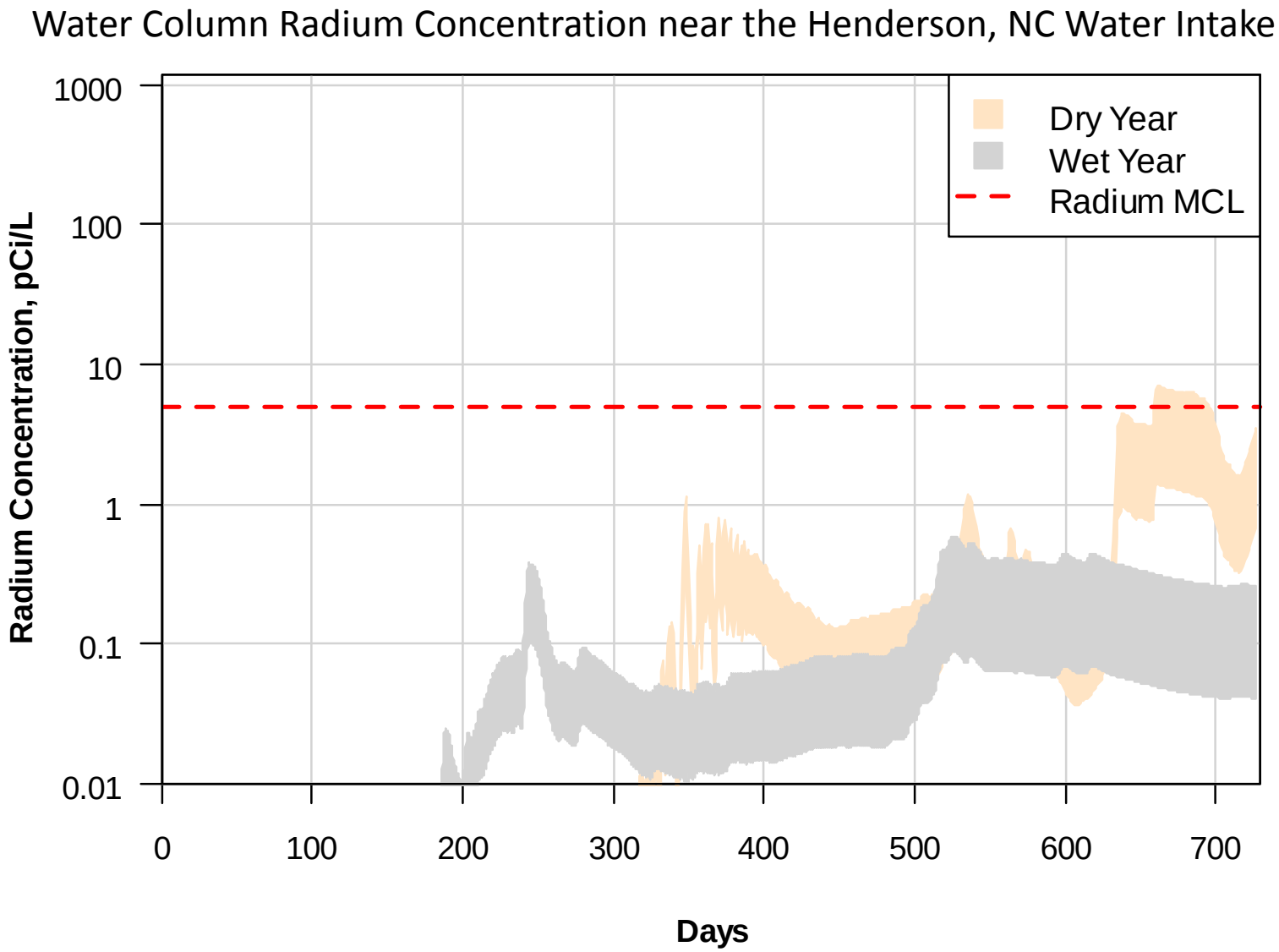
Impact to Kerr Lake
(Dry Year – High Solubility - Radium)



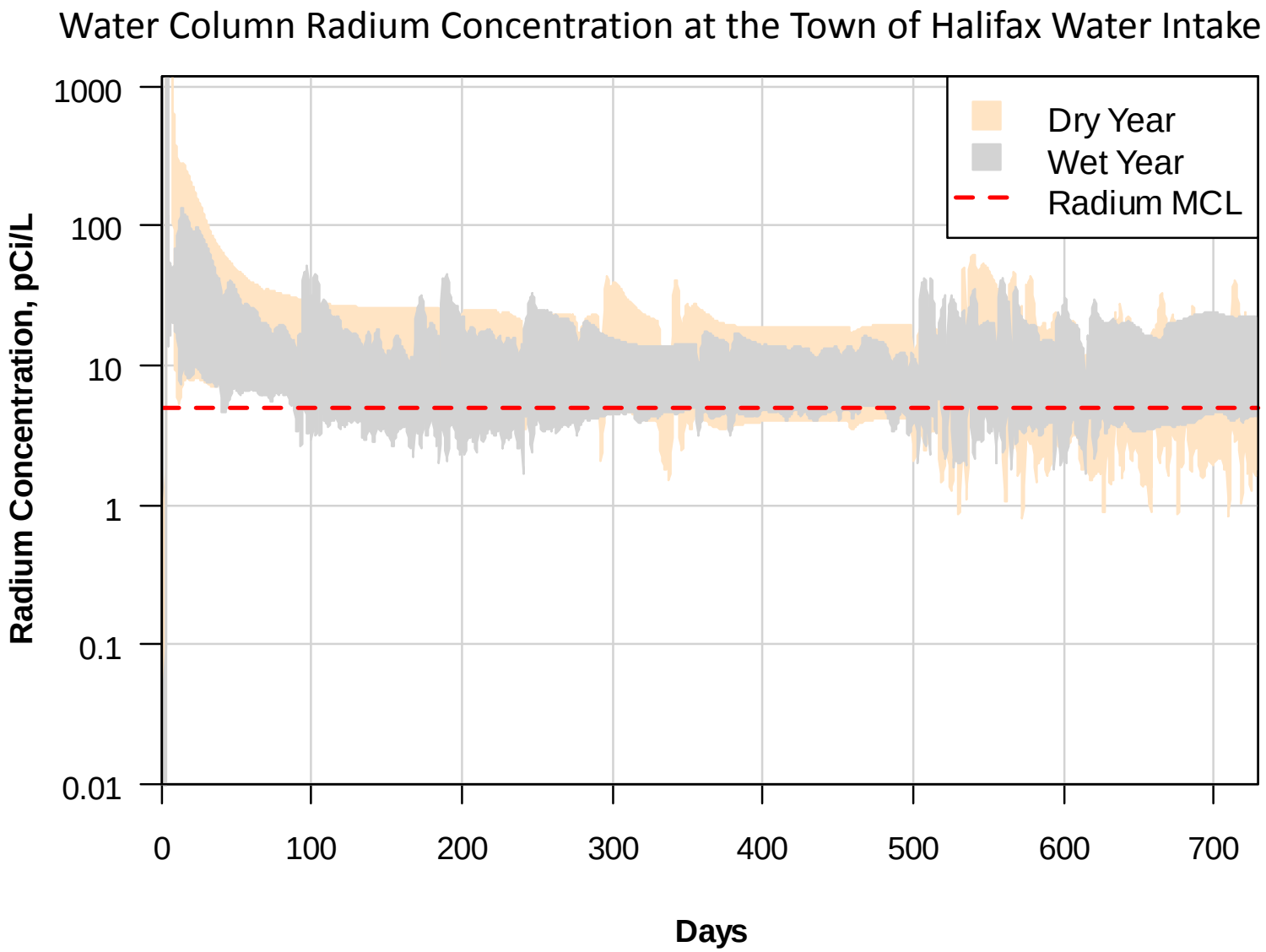
Impacts to Kerr Lake



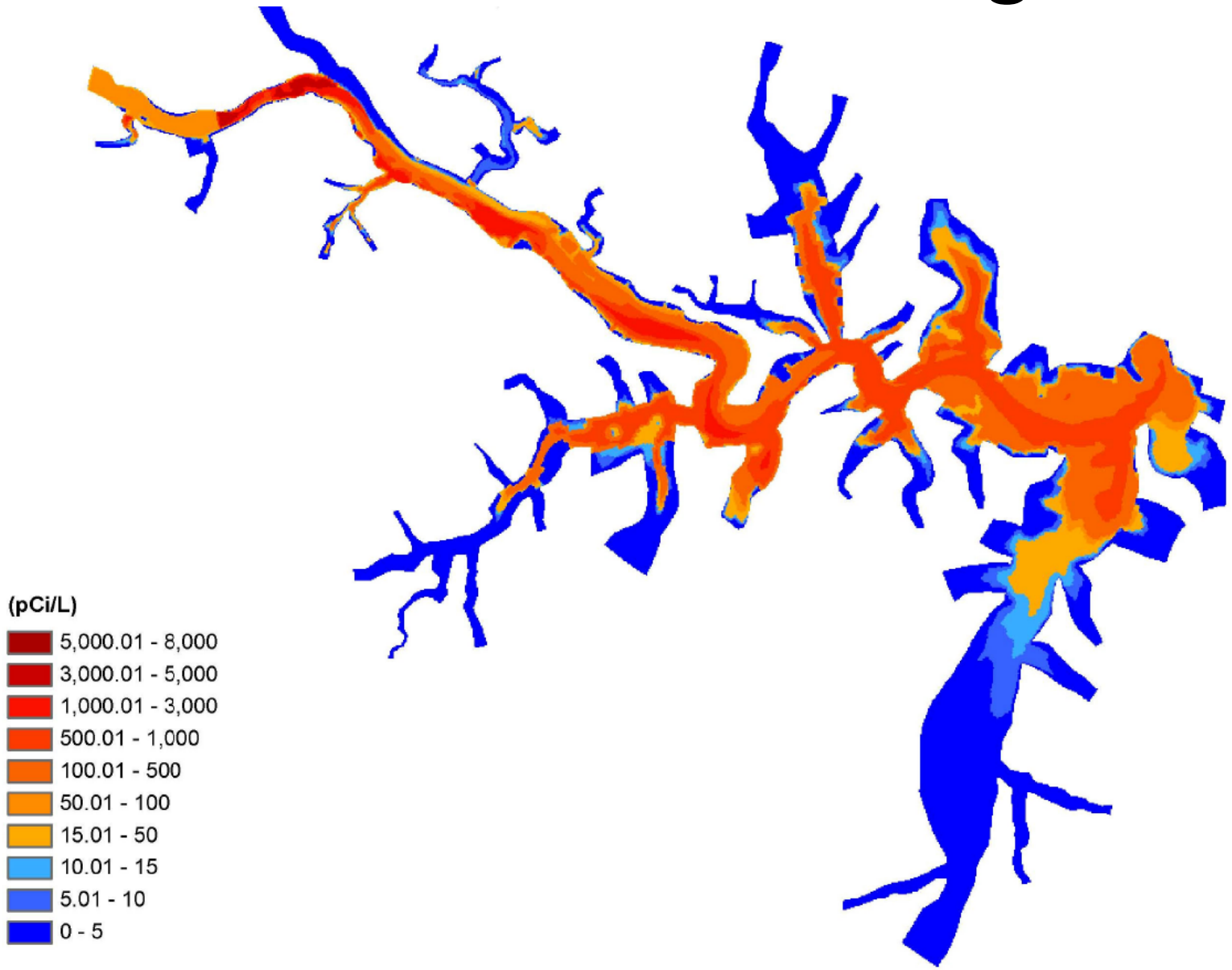
Impacts to Kerr Lake



Impacts to Banister River



Fate of the Tailings



Fate of the Tailings

Water Body	Fraction of Contaminants Remaining in Sediments 2 years After Tailings Release		
	Radium	Thorium	Uranium
Banister River	54% - 83%	77% - 84%	67% - 78%
Kerr Lake	0.1% - 3.4%	2.3% - 4.2%	0.4% - 3.3%
Lake Gaston	0.03% - 0.4%	0.2% - 0.5%	0.1% - 0.6%

General Conclusions

- The impact of a tailings release into the Banister River is highly dependent on the stream flows in the watershed.
- Under any scenario, the partial release of the contents from only one containment cell, will likely result in contaminant concentrations above the SDWA levels.
- The impact is most significant upstream and in the main channels of the reservoirs

General Conclusions (2)

- Contaminant concentrations in the water column of the reservoirs will decrease below SDWA levels within 2 years, but they will be will likely remain elevated for several years in Banister River.
- Most of the contaminated particulate matter will remain in the Banister River bed sediments for the foreseeable future.
- The contaminated sediments can be re-mobilized during flood events and flushed downstream

Lake Gaston near Pea Hill Creek

- Radioactivity (radium and thorium) would remain above the MCL
  - For 1 to 21 days during wet years
  - For 7 to 10 months during dry years
- Radium Levels would remain above the MCL
  - For 2 to 8 weeks during wet years
  - For 6 to 16 months during dry years
- Uranium would be elevated but not exceed the MCL

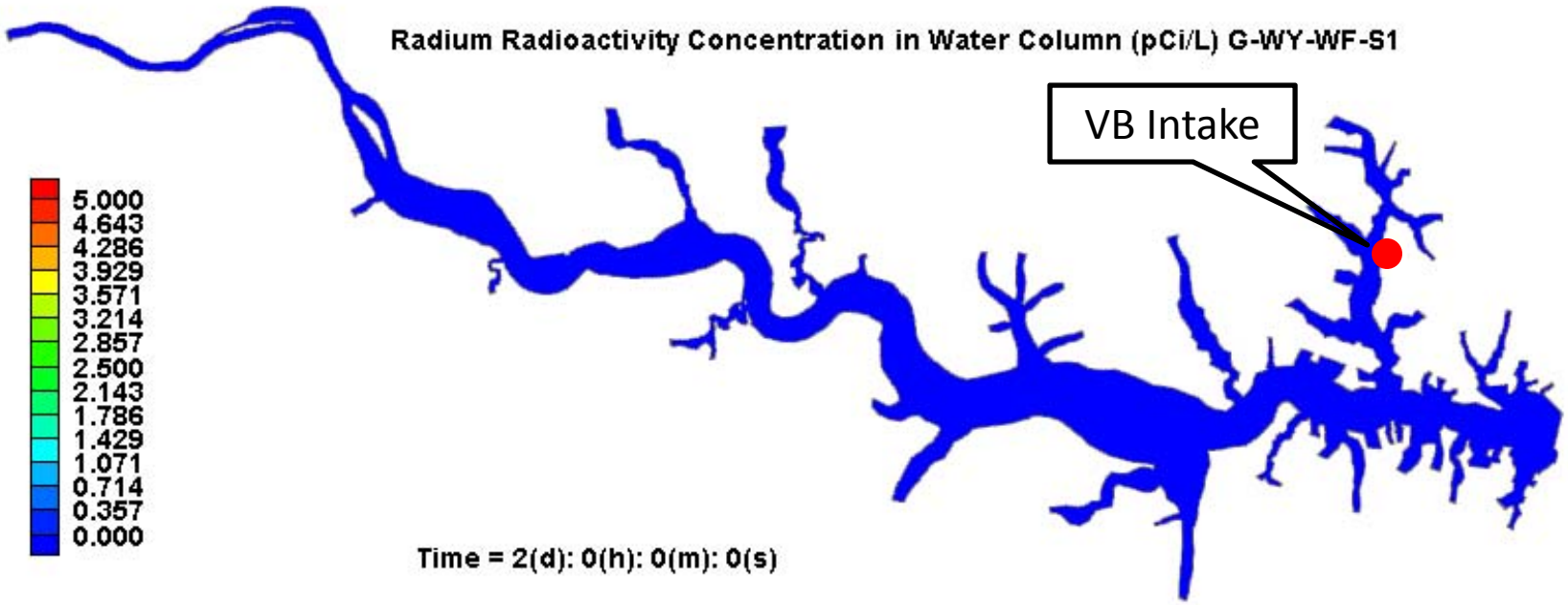
City of Virginia Beach Intake

- If the pump station remained offline, no contamination would migrate into Pea Hill Creek
- However, the inability to withdraw water from Lake Gaston for up to 1.5 years would result in severe water shortages for the Cities of Virginia Beach, Chesapeake and Norfolk

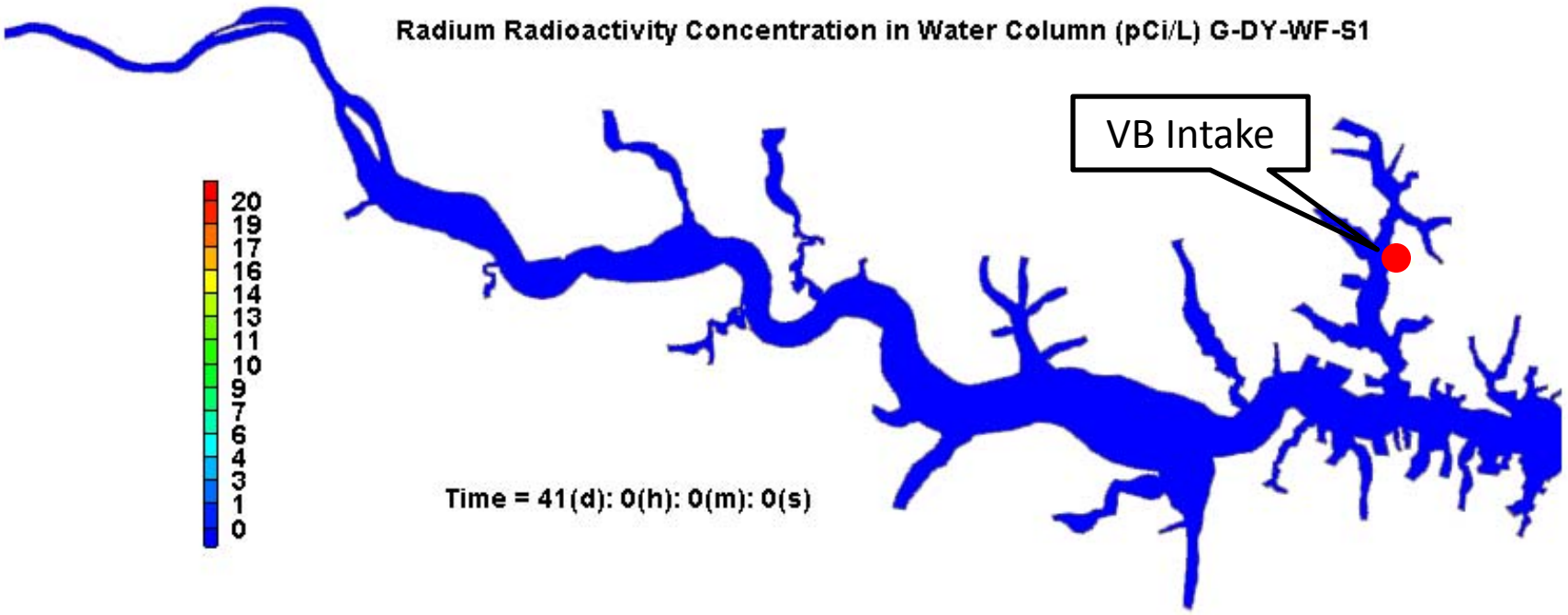
Questions

http://www.vbgov.com/government/departments/public-utilities/pages/uranium-mining.aspx

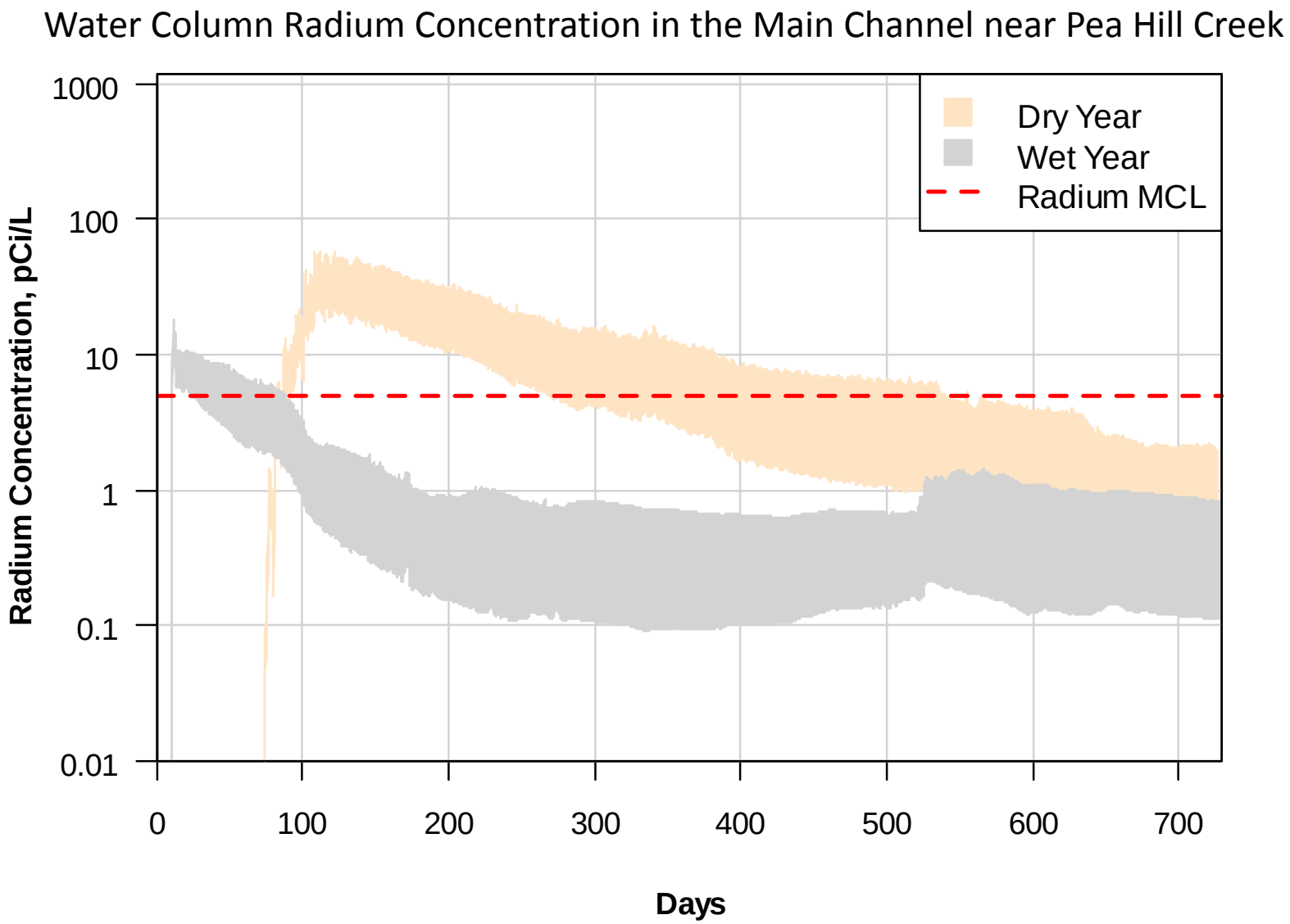
Impact to Lake Gaston
(Wet Year – High Solubility - Radium)



Impact to Lake Gaston
(Dry Year – High Solubility - Radium)



Impacts to Lake Gaston



Fate of the Tailings