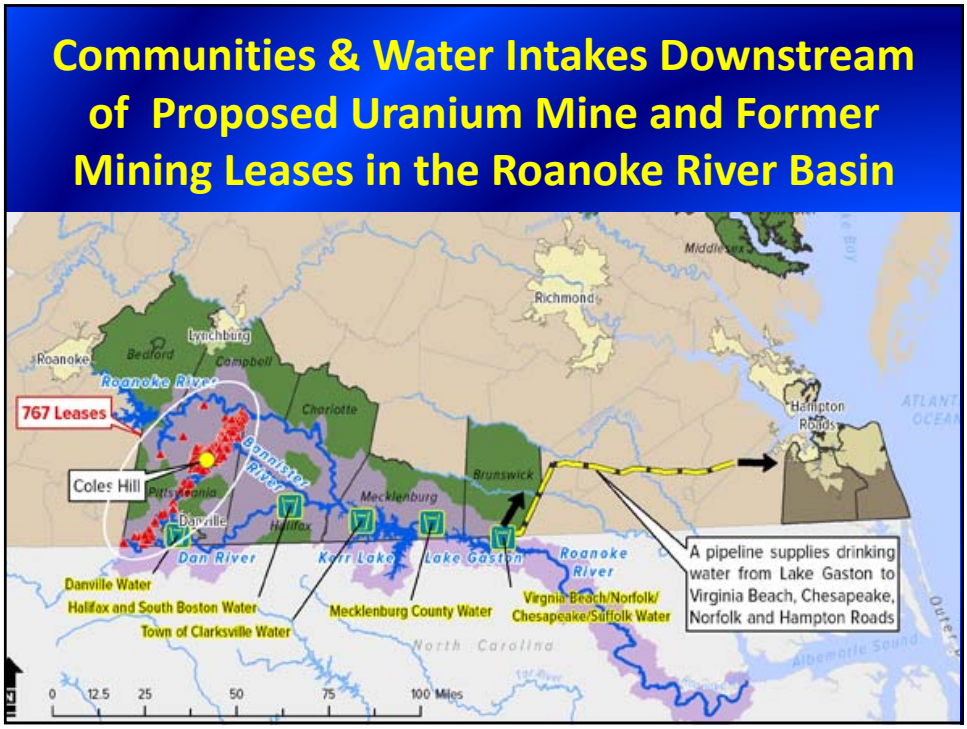
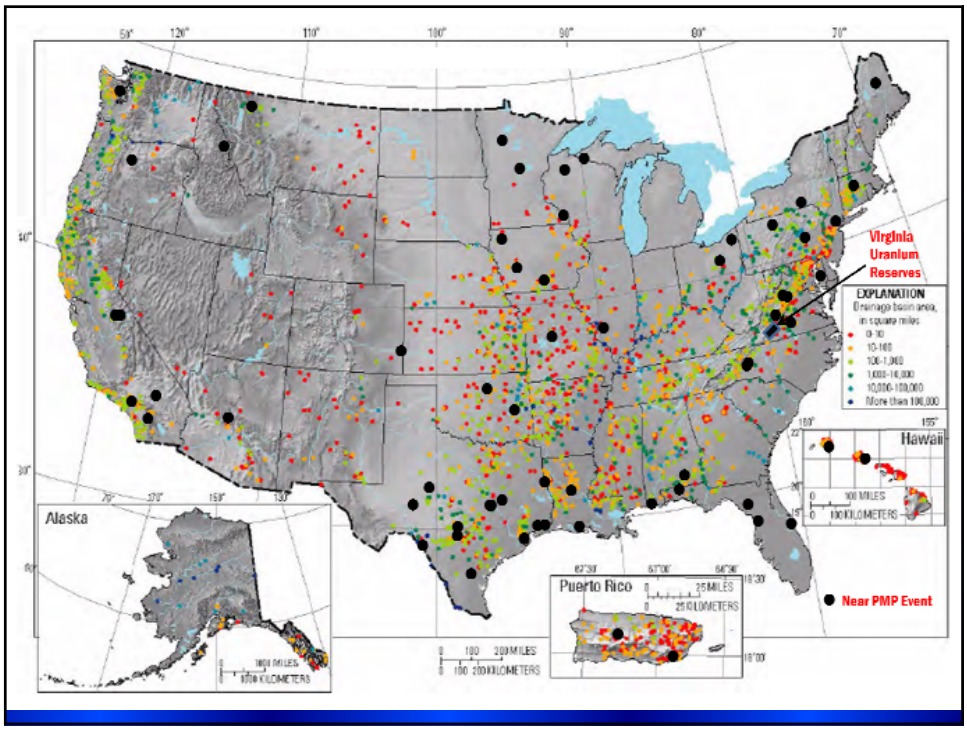
City of Virginia Beach
Uranium Mining Impact Study

City Council Briefing
June 5, 2012

Uranium Mining in Virginia

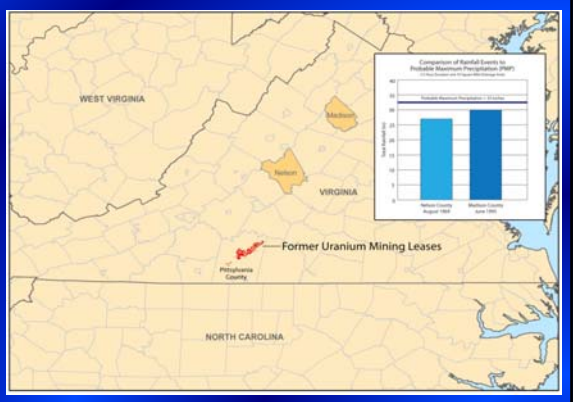
- Excavate uranium ore: 20-76 MCY of solid rock
- Grind ore into sand and clay-like particles
- Leach out uranium – about 0.1% of the ore
- Dispose of tailings – about 99.9% of the ore
  - Tailings retain 85% of the total radioactivity for hundreds of thousands of years
  - Unlike original ore (buried solid rock), tailings are highly mobile via air and water
  - Tailings must be secured in disposal cells that may be above or below grade


Communities & Water Intakes Downstream of Proposed Uranium Mine and Former Mining Leases in the Roanoke River Basin
767 Leases
Coles Hill
Roanoke
Bedford
Lynchburg
Campbell
Roanoke River
Pittsylvania
Danville
Dan River
Halifax
Charlotte
Mecklenburg
Brunswick
Kerr Lake
Lake Gaston
Roanoke River
Richmond
Hampton Roads
Danville Water
Halifax and South Boston Water
Town of Clarksville Water
Mecklenburg County Water
Virginia Beach/Norfolk/ Chesapeake/Suffolk Water
A pipeline supplies drinking water from Lake Gaston to Virginia Beach, Chesapeake, Norfolk and Hampton Roads
North Carolina
0 12.5 25 50 75 100 Miles


Virginia Uranium Reserves
EXPLANATION
Drainage basin area, in square miles
Alaska
Hawaii
Puerto Rico
Near PMP Event

Near PMP Storms in Virginia

- **Examples:**
  - Nelson County – August 1969
    - 27 – 31 inches in 8-hours (Hurricane Camille)
  - Madison County – June 1995
    - 30 inches in 14 hours



Uranium Mining at Coles Hill

- Originally: 119 million # of uranium (0.06% ore)
  - 100 million pounds of yellow cake
  - Open-Pit, 76 MCY of tailings
- Currently: 60 million # of uranium (0.11% ore)
  - 50 million pounds of yellow cake
  - Deep Shaft, 20 MCY of tailings
  - Less than half of tailings returned to mine shafts
  - Remaining tailings disposed in eight *"surface tailings impoundments"* according to VUI feasibility study
- VUI is not bound by any plan. Mining economics, price of uranium, and regulations at the time will dictate the alternative pursued by the company

City of Virginia Beach Position

Unless it can be demonstrated to a reasonable degree of certainty that there will be no significant release of radioactive sediments downstream, the City of Virginia Beach is opposed to:

- Uranium mining in Virginia, including the proposed Virginia Uranium operation
- The elimination of the existing legislative moratorium on uranium mining
- Any attempt to develop a regulatory framework for uranium mining

City Council Resolution, December 2, 2008

Uranium Mining in Virginia Studies

- Two Economic Studies
  - Chmura: *The Socioeconomic Impact of Uranium Mining and Milling* – November 2011
  - RTI, International: *Proposed Coles Hill Uranium Mine and Mill* – March 2012
- National Academies of Sciences (NAS) Study
  - *Uranium Mining In Virginia* – December 2011
- Virginia Beach/Michael Baker Engineers Study
  - *Potential Impacts of Uranium Mining in Virginia on Drinking Water Sources* – February 2012 (Phase II)

Chmura & RTI Economic Studies

- 1,000 jobs and $150 million economic impact to the region's economy per year (20 to 35 years)
- Even if compliant with all environmental regulations, there would be moderate and measurable air, water and soil contamination and impacts close to the facility
- One large, or several small accidents/spills would significantly reverse the economic benefit even if no serious harm to people or the environment occurred

NAS on the Potential for Impacts

- Uranium mining in VA has the potential for significant, long-term environmental impacts
- VA experiences extreme natural events
- Tailings disposal cells represent significant long-term risks and may release tailings if not designed, constructed and maintained to withstand such events, or fail to perform as planned

NAS on the Regulatory Environment Needed to Safely Mine Uranium in VA

- Rigorous and sustainable uranium mining, milling, and tailings disposal regulatory programs based upon world-wide best practices, such as those in Colorado and Canada
- Fully empowered and funded agencies with strong data-gathering, inspection and enforcement powers
- A culture and philosophy embedded in these programs in which compliance with regulations is only the beginning of the licensing process

NAS on the Existing Regulatory Environment

- Virginia has no experience with uranium mining
- Nuclear Regulatory Commission has no experience in states with wet climates and high precipitation events
- *"there are gaps in legal and regulatory coverage for . . . uranium mining, processing, reclamation, and long-term stewardship."*
- *"there are steep hurdles . . . before mining and/or processing could be established within a regulatory environment that is . . . protective of the health and safety of workers, the public, and the environment."*

Virginia Beach/Michael Baker Study

- Computer simulation of downstream water quality impacts from a theoretical catastrophic breach of a, single, above grade, uranium mine tailings disposal cell
- Prepared by Michael Baker Engineers and the National Center for Computational Hydroscience and Engineering, University of Mississippi
- One-dimensional river and two-dimensional reservoir model, with sediment transport and water quality prediction capabilities

Virginia Beach/Michael Baker Study

- The <u>only</u> valid question raised is the above-grade vs below-grade tailings disposal argument
- The threat to surface water will be dramatically reduced if the tailings are stored below grade
  - The presumption of below-grade disposal was explicitly dismissed in the NAS study
  - Prior engineering study ruled out below-grade storage because of groundwater conditions
  - USGS presentation to NAS: Groundwater in the region is shallow and mobile – but data is limited

NAS on Below Grade Disposal

[T]he use of partially above-grade tailings facilities cannot be discounted. For example, the Piñon Ridge uranium mill, the first new uranium mill in the United States in a generation, recently received license approval from the state of Colorado. At that site, full below-grade tailings disposal was considered the best option, but a partially above-grade design with perimeter berms satisfied the relevant regulations and was recommended following detailed site-specific characterization. Therefore, the potential hazard of a sudden release resulting from the failure of a constructed retaining berm remains. An aboveground tailings dam failure (e.g., due to liquefaction associated with a seismic event, an exceptionally high rising rate from local precipitation, improper spillway design leading to overtopping) would allow for a significant sudden release of ponded water and solid tailings into receiving waters.

Source: Uranium Mining in Virginia, NAS Committee on Uranium Mining, December 2011, responding to arguments lodged against the Baker model. Emphasis added.

Virginia Beach/Michael Baker Study

- The model does not simulate how or why a disposal cell might fail – it simulates the outcome if one did fail as a result of a catastrophic precipitation event
- Worst case scenario for a single, above grade cell failure on the Banister River
- The event is unlikely and one that technology and regulations should prevent

Technology and Regulations Aren't Perfect

Dec 2008 - Associated Press: Inspections are being ramped up at a California nuclear plant where a battery that powered safety systems didn't work for four years . . .The utility says it will focus on preventing a recurrence.

Feb 2010 - Associated Press: Radioactive tritium, a carcinogen discovered in potentially dangerous levels in groundwater at the Vermont Yankee nuclear plant, has now tainted at least 27 of the nation's 104 nuclear reactors — raising concerns about how it is escaping from the aging nuclear plants.

Nov 2011 - Richmond Times-Dispatch: Dominion Virginia Power and federal nuclear regulatory staff members covered up knowledge of geologic faulting at the North Anna Power Station site in 1973, according to a U.S. Justice Department memo.

Technology and Regulations Don't Always Prevent Catastrophes

- 1976: Grand Teton Dam - Failed While Being Filled
  - Unknown geological factors and design flaws
- 1979: United Nuclear Corp – 0.5 MCY Tailings Liquor Spill
  - Tailings impoundment failed – Design and construction flaws
- 2000: Massey Energy – 1.5 MCY Coal Sludge Spill
  - Tailings impoundment failed - Subsurface structural defects
- 2008: TVA Kingston Fossil Plant – 5.0 MCY Fly Ash Spill
  - Tailings impoundment failed – Liquefaction and excess rain
- 2010: Deep Water Horizon - Oil Well Blowout
  - The company, the regulatory agency, and the "failsafe" blowout preventer, all failed

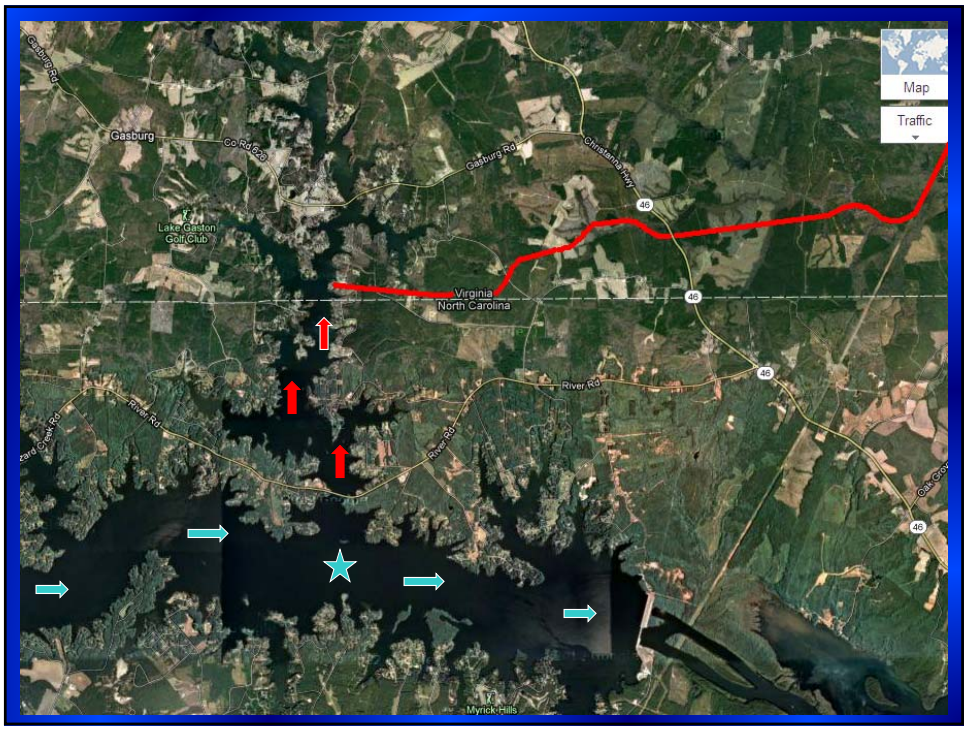
Model Assumptions

- Release of 0.7 MCY of tailings following a hypothetical disposal cell breach caused by a catastrophic precipitation event
- Discharge to Banister River near Coles Hill
- Tailings release is followed by either
  - Wet period (Sep 1996 – Aug 1998)
  - Dry period (Jun 2001 – May 2003)
- Lake Gaston pump station does not operate
- Three contaminants are modeled: radium, thorium, uranium

VA Beach/Baker Study Results

- 10-20% of radioactivity remains in the water column and flows downstream, thru Kerr & Gaston
- 80-90% of the radioactivity settles in the river and reservoir beds, mostly in the Banister River
- Of the three contaminants modeled, radium has the most impact in the water column in terms of the SDWA and CWA
- Radioactivity in the sediments is a far more significant and longer-term environmental problem than in the water column

Map
Traffic
Gasburg
Lake Gaston Golf Club
Virginia
North Carolina
River Rd
Myrick Hills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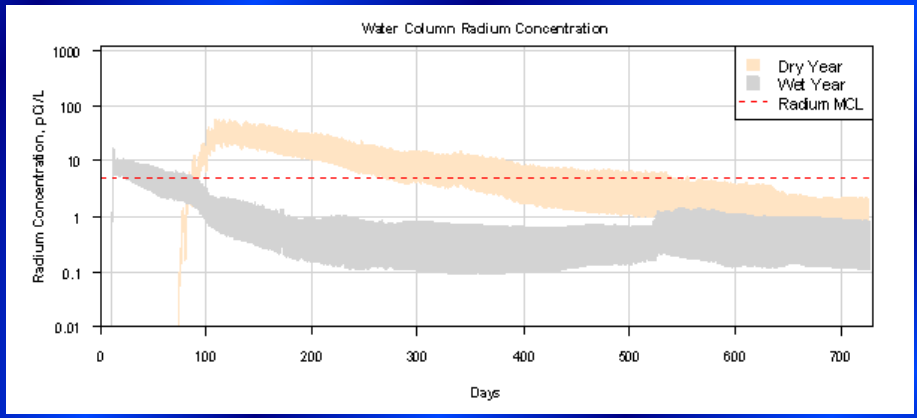
Water Column in Lake Gaston Near Confluence with Pea Hill Creek



Videos Showing Progression of Radium Through Kerr Reservoir and Lake Gaston

Kerr Reservoir Dry Year Video

Lake Gaston - Dry Year Video

Impacts in Lake Gaston

- Elevated uranium, but less than the Maximum Contaminant Level (MCL)
- Total Radioactivity (radium plus thorium) would remain above the MCL
  - Less than a month during wet years
  - 7 to 10 months during dry years
- Radium radioactivity would remain above the MCL
  - Up to two months during wet years
  - 6 to 16 months during dry years

Water Supply Intakes

- Contaminants would be problematic for some water systems
  - Even if WTP could meet the MCL, there would be significant public relations/public acceptance issues
- VA Beach would shut off the intake
  - Drawing radioactive contaminants into Pea Hill Creek would certainly be opposed
  - Discharging those contaminants into the Ennis Pond channel likely to involve the CWA
  - Lake Gaston supplies about one-third of water supply for Norfolk, Chesapeake, and Virginia Beach during droughts

Uranium Mining in VA: Bottom Line

- Significant benefits to the local economy unless there was one big accident or several small ones
- It could be done safely but the necessary regulatory framework is not in place today and there are "steep hurdles" to overcome before it ever would be
- Although unlikely, extreme natural events combined with man-made errors could result in a significant tailings release from above grade tailing disposal cells
- A catastrophic breach of an above grade disposal cell would force the Gaston pipeline to shut down for a period of months to more than one year

Recommendation

- Although the Nuclear Regulatory Commission will be the regulator of tailings disposal, federal regulators give great weight to the hosting state in all aspects of the regulatory process
- Virginia has never had the requisite regulatory attitude identified by the NAS – Will it ever?
- The probability of a major tailings release is small, but the consequences are great
- Criteria in the 2008 resolution have not been met, the City should update and reaffirm its opposition to uranium mining in Virginia

Questions?