

URANIUM STUDY COMPARISONS

The purpose of this comparison of uranium studies is to provide a framework to examine the findings regarding possible outcomes if uranium mining and milling occur at the Coles Hill site in Pittsylvania County, Virginia.

Questions answered include:	National Academy of Sciences Study	RTI Uranium Report	Chmura Study	Virginia Beach Study	Moran Report	Fairfax Study
<ul style="list-style-type: none"> Who funded the study? 	<ul style="list-style-type: none"> Funding provided under a contract with the Virginia Center for Coal and Energy Research (VCCER) of Virginia Polytechnic Institute and State University (Virginia Tech); funding for the study was provided to Virginia Tech by Virginia Uranium, Inc. (p. 1). 	<ul style="list-style-type: none"> Study funded by Danville Regional Foundation (DRF) (p. 1-1). 	<ul style="list-style-type: none"> Study funded by the Virginia Coal and Energy Commission (p. 6). 	<ul style="list-style-type: none"> Study funded by City of Virginia Beach, Virginia (Virginia Beach, VA, Government Website). 	<ul style="list-style-type: none"> Report funded by Roanoke River Basin Association (p. 4) 	<ul style="list-style-type: none"> Fairfax Water authorized Hazen and Sawyer Environmental (Engineers & Scientists) to prepare the study (p. 2).
<ul style="list-style-type: none"> Why was the study conducted? 	<ul style="list-style-type: none"> The formal task statement for the study committee was to investigate physical and social context in which uranium mining and milling might occur; occurrences and exploration status of uranium in Virginia and global and national uranium markets; technical options and best practices that might be applicable within Virginia; and potential impact on occupational and public health, safety, and the environment (p. 1). 	<ul style="list-style-type: none"> The purpose of the socio-economic study was to evaluate the potential impacts of developing and operating a uranium mine and mill on a region within 50 miles of Coles Hill (p. 1-1). 	<ul style="list-style-type: none"> Chmura Economics and Analytics (Chmura) was charged with producing a socioeconomic study to broadly consider the net benefits from a mining and milling operation in the Commonwealth (p. 6). 	<ul style="list-style-type: none"> The study is designed to address the estimated amount of uranium-contaminated sediment and water that might reach Kerr Reservoir under normal and extreme precipitation events and to estimate the potential increase in radioactivity levels and uranium in Kerr Reservoir (p. 3). The model does not address the issue of whether there will be a catastrophe – it only simulates the outcome if one did occur (Study Briefing Document, p.2). The study is simulating a rare event that regulations are supposed to prevent (Study Presentation Material, Slide 7). 	<ul style="list-style-type: none"> Report focuses on water-related technical issues (p. 4). 	<ul style="list-style-type: none"> The purpose of the study is to evaluate the potential for impacts to Fairfax Water's water supplies for uranium mining and associated activities if the uranium mining moratorium currently in place in the Commonwealth of Virginia is lifted (p. 3).
<ul style="list-style-type: none"> What are the positive and negative environmental and health impacts of uranium mining and milling? 	<ul style="list-style-type: none"> Mine dewatering activities have the potential to impact surface water quality, particularly if the discharge is not treated (p. 152). Groundwater is an important resource throughout Virginia. In 2008, groundwater withdrawals constituted 22 percent of the freshwater used in Virginia. About 22 percent of Virginia's population used privately owned domestic wells for their drinking water with heavier use in rural locations (p. 35). In the recent past, most uranium mining and processing has taken place in parts of the United States that have a negative water balance (dry climates with low rainfall); and consequently, federal agencies have little experience developing and applying laws and regulations in locations with abundant rainfall and groundwater, and a positive water balance (wet climates with medium to high rainfall), such as Virginia (p. 16). 	<ul style="list-style-type: none"> Mining and milling at the Coles Hill site bring risk to the region in respect to reputation, health, and environment (p. 6-41). Although controlled, potential exists to emit air contaminants in the form of fugitive dust, and radon gas, and water containing radiological compounds, metals, and solids (pp. 7-13). The proposed mine, mill and waste-storage facility will have an impact on the availability of water and water quality in the region. Because of the depth of the mine and the level of groundwater in the area, water will have to be continuously pumped from the mine, a process known as dewatering. This will impact area farms and residences with the area of impact being difficult to predict (pp. 7-16). 	<ul style="list-style-type: none"> Given the assumptions of the baseline scenario, the Coles Hill operation poses minimal risk to degrade the surrounding environment – air, soil, and water. Natural vistas and landscapes within a one-mile radius of the site are likely to be negatively altered (p. 10). Under the assumptions of the baseline scenario, the Coles Hill operation will not result in any increase in cancer rates or other fatal illnesses. A portion of the approximately 2,700 people living within five miles of the Coles Hill site, who are already sensitive to air quality issues, could experience increased asthma-related symptoms or other respiratory problems (p. 10). Any plan to mine and mill uranium at Coles Hill must consider negative water implications arising from run-off of moisture from mine waste, mill tailings, and stockpiled ore that will be located on site. Additional consideration must be made for the dewatering of underground works through constant pumping of water to the surface for processing (p. 98). 	<ul style="list-style-type: none"> A catastrophic failure of a uranium tailings containment structure could significantly increase radioactivity concentrations in the river/reservoir system and exceed the maximum containment level established for radiological contaminants for drinking water for an extended period of time (p. ES-7). A significant amount of radioactivity remains in the river/reservoir system after a year following a catastrophic tailings dam failure (p. ES-7). 	<ul style="list-style-type: none"> The project, as proposed, may generate at least 28 million tons of solid uranium mill tailings and roughly the same amount of liquid waste. The solid wastes would remain on site forever, requiring maintenance forever. Uranium mill tailings would contain radionuclides, heavy metals, and other toxic elements (p. 2). Undiluted tailings liquids may contain 1,160 to 1,460 times the existing Safe Drinking Water Act standard for uranium. Undiluted tailings liquids may contain 2,300 to 2,900 times the allowable uranium concentrations when compared to the short-term Canadian aquatic life guidelines (p. 3). As proposed, the Coles Hill project would require over five (5) billion gallons of water. During the start-up period, the project would use at least 525.6 million gallons per year (p. 3). It has been estimated that at least 136 million gallons of ground water (mostly), per year, would flow into the open pit. This water would become contaminated with numerous radioactive and non-radioactive contaminants. To allow mining, this contaminated water must be pumped out of the pit and discharged to some undefined location (p. 3). 	<ul style="list-style-type: none"> The study concludes that uranium mining and milling, specifically, represent unique risks that require additional process controls to prevent impacts from toxic and radioactive byproducts. Uranium mining and milling activities initiated in the Potomac and/or Occoquan watersheds could increase the risk of negative impacts to Fairfax Water's source water quality and water supply reliability (pp. 40-44). Under the worst case scenario, a catastrophic failure of an impoundment will render the impacted water supply unusable for a significant period of time. Risk to the watershed will be essentially permanent because of the amount of radiation from the tailings contained in impoundments. A total of 4.3 million people would be without useable water, with no long-term replacement for the loss of water resources in the Virginia region (p. 72).
<ul style="list-style-type: none"> What are the positive and negative economic and social impacts of uranium mining and milling? 	<ul style="list-style-type: none"> 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 (p. 8). In general, uranium price trends since the early 1980s have closely tracked oil price trends. The Chernobyl (Ukraine) nuclear accident in 1986 did not have a significant impact on uranium prices, while it is too early to know the long-term uranium demand and price effects of the Fukushima (Japan) accident (p. 78). 	<ul style="list-style-type: none"> Under the best reasonable scenario, the mine and mill will add approximately 900 jobs (pp. 7-22). Under the reasonable scenario, the mine and mill will add approximately 700 jobs (pp. 7-22). Under the worst possible case scenario, the mine and mill will produce a net decrease in the number of jobs in the region of approximately 150 jobs (pp. 7-22). Under any scenario, employment levels at the facilities will fluctuate because of the historic volatility of the market price of uranium (pp. 7-21). 	<ul style="list-style-type: none"> During the operational phase the Coles Hill site will support 1,052 jobs in Virginia, with approximately half of these jobs projected to be filled by the residents of the Chatham Labor Shed (p. 9). This impressive, positive economic impact is the net projection of anticipated socioeconomic costs realized due to possible negative stigma effects, added costs of regulation, added use of public services, emergency planning, and risks to public health and the environment (p. 9). Assuming the Commonwealth of Virginia becomes an agreement state for the purposes of regulating the mill tailings portion of the Coles Hill operation, Virginia will need to spend an additional \$2.5 million per year to monitor the industry (p. 9). Given the assumptions of the baseline scenario, any negative stigma effects on real estate are likely to be localized, short-lived, and minimal. Chmura estimates that the approximately 175 residences located within a 2-mile radius are likely to see an impairment of their real estate values. Chmura estimates this loss to be five (5) percent (p. 9). 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> All such large-scale uranium projects involve trade-offs, usually some short-term jobs, etc. in exchange for long-term impacts (environmental, socioeconomic, etc.), most of which are paid by future generations. Thus, many of the long-term costs will be subsidized by the public (p. 3). 	<ul style="list-style-type: none"> Information not provided.
<ul style="list-style-type: none"> Are there recommendations for best regulatory and monitoring practices regarding the Coles Hill mine and mill? 	<ul style="list-style-type: none"> There is only limited experience with modern underground and open pit uranium mining and milling and processing practices in the wider U.S. and no such experience in Virginia (p. 8). However, if the moratorium on uranium mining and milling is lifted, statutes and regulations would have to be written to ensure minimal permanent impact on the environment and to protect public health. Suggestions include establishment of a financial surety, transparent and sufficient inspection and enforcement tools, establishment of a new law or law, federal and state cooperation during the regulatory process, and environmental impact assessment prior to commencement of any mining activity (pp. 222-223). There exist internationally accepted best practices, founded on principals 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 (p. 223). 	<ul style="list-style-type: none"> Key factors exist that can mitigate potential impacts to human and ecological health if the Coles Hill mine and mill were constructed. These include a comprehensive baseline before mine is built, comprehensive and ongoing monitoring, use of effective technologies to reduce emissions, sustained focus on pollution prevention and reduction, collaboration and transparency between mining company, regulators, and citizens, and expedient and effective reclamation activities (pp. 7-18 to 7-19). Pollution control technologies are widely available today to minimize mining and milling waste discharges in water, air, and soil. Such technologies would increase the likelihood that the proposed mining and milling in Virginia would comply with current regulations. Furthermore, the mine could develop practices to exceed regulatory standards in an effort to reduce potential liabilities and further diminish public concerns over the mine (pp. 7-19). 	<ul style="list-style-type: none"> Recommendations include the signing of an "Impact-Benefit Agreement" between VUI and Pittsylvania County, the establishment of permanent Environmental Quality Committees, and the utilization of "adaptive management" practices by VUI (p. 10). 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> There is no credible evidence to indicate that either the Federal or State regulatory agencies have sufficient staff, budgets, or political clout to adequately oversee and enforce the appropriate regulations (p. 3). Statistically adequate baseline data (water quality, quantity, etc.) have never been collected, compiled and interpreted, or released to the public. Thus, the public has no reliable "yardstick" against which to demonstrate that changes have occurred, or not (p. 3). 	<ul style="list-style-type: none"> Track Virginia's status with respect to regulatory authority over uranium mining and milling operations. If needed, conduct detailed evaluations of state regulator experience in this domain (p. 73).
<ul style="list-style-type: none"> How long is the Coles Hill mine and mill expected to operate? 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> The mine and mill, if approved, would be in operation for an estimated 35 years (p. 2-1). 	<ul style="list-style-type: none"> Projected 35 years of operation (p. 6). 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> Information not provided.
<ul style="list-style-type: none"> What are projected tax revenues for the state and local region during the life of the mine and mill? 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> Operations would result in annual revenues from taxes and dividends, sales tax, property tax, and personal and corporate income taxes, totaling an estimated \$11.2 million per year (pp. 6-22). 	<ul style="list-style-type: none"> The operational phase will produce approximately \$3.1 million per year in state and local taxes (p. 9). 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> While it is true that there will be some tax revenue increases to local and state governments and new income for some workers, the vast majority of the profit will be absorbed by the company and its stakeholders (p. 30). 	<ul style="list-style-type: none"> Information not provided.
<ul style="list-style-type: none"> Are there uranium mines and mills in the United States, or internationally, with which to compare the proposed Coles Hill site? 	<ul style="list-style-type: none"> The most comparable area for the type of deposit that may exist occurs in the Variscan belt of France and the southeastern part of Germany. These two countries have climactic conditions very comparable to those of Virginia, with temperate and relatively humid climates, a strong vegetation coverage, extensive farming and relatively high population density (p. 60). 	<ul style="list-style-type: none"> There is no mine and mill that mirrors the characteristic of the proposed VUI mine and mill and its surrounding areas. Elements of the characteristic examined for comparison are population density, precipitation and terrain (pp. 7-9). 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> Information not provided. 	<ul style="list-style-type: none"> Most past U.S. uranium mining and milling has been conducted in the arid West usually in regions quite isolated from significant populations. Many of these sites receive less than 10 inches of annual precipitation, sometimes much less. The Coles Hill site receives roughly 42 inches annual precipitation, rendering long-term water and waste management much more difficult (p. 19). Most important, within a radius of two (2) to three (3) miles, Coles Hill has roughly 250 private wells, at least one dairy and numerous hay/forage fields, which are liable to be impacted (p. 2). 	<ul style="list-style-type: none"> Information not provided.
<ul style="list-style-type: none"> What is the final conclusion of the report? 	<ul style="list-style-type: none"> 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 (p. 223). 	<ul style="list-style-type: none"> Overall, the proposed mine and mill present both potential risks and rewards to the study region. Rewards include approximately 700 jobs and an added \$162 million to the region's economy each year for more than 20 years. Risks include both actual environmental risks and perceived risks that could hurt the region's reputation. Risks could be significantly reduced if appropriate investments are made in design, pollution control technologies, regulatory development and implementation, and ongoing commitments are made to frequent monitoring and transparent communication (p. ES - 24). 	<ul style="list-style-type: none"> In the opinion of Chmura, the mining and milling operations would bring substantial and much needed economic benefit to Pittsylvania County, the immediate surrounding areas, and the state (p. 6). 	<ul style="list-style-type: none"> Conclusions could be impacted depending on the variation in key parameters, such as dam height for the uranium tailings containment structure, sediment concentration in the tailings, radioactivity level, uranium content, solubility characteristics of radiological elements and uranium, and the particle-size distribution (p. 221). Significant amounts of radioactivity concentrations occur with significant failure of containment structure (p. 221). 	<ul style="list-style-type: none"> This paper offers recommendations to decision-makers and communities on measures that should be taken to protect the public welfare prior to the commencement of the project. Specifically, the paper discusses the importance of the baseline data collection and sufficient bonding (p. 2). 	<ul style="list-style-type: none"> Actions recommended as the Virginia legislature considers lifting the uranium mining ban include emphasizing source water protection as a critical component of the drinking water treatment process and creating state regulations that are more region specific (p. 72).
<ul style="list-style-type: none"> Source Citations 	<ul style="list-style-type: none"> National Academy of Sciences. 2012. <i>Uranium Mining in Virginia: Scientific, Technical, Environmental, Human Health and Safety, and Regulatory Aspects of Uranium Mining and Processing in Virginia</i>. Washington, D.C.: National Academies Press. www.nap.edu/catalog.php?record_id=13266 	<ul style="list-style-type: none"> RTI International. 2012. <i>Proposed Uranium Mine and Mill, Coles Hill Virginia: An Assessment of Possible Socioeconomic Impacts</i>. Research Triangle Park, NC. drfonline.org/news/2011/documents/RTI-Final-Report.pdf 	<ul style="list-style-type: none"> Chmura Economics & Analytics. 2011. <i>The Socioeconomic Impact of Uranium Mining and Milling in the Chatham Labor Shed, Virginia</i>. Richmond, VA & Cleveland, OH. www.chmuraecon.com/pdfs/Uranium.pdf 	<ul style="list-style-type: none"> Michael Baker Corporation. 2011. <i>A Preliminary Assessment of Potential Impacts of Uranium Mining in Virginia on Drinking Water Source</i>. Moon Township, PA. www.vbgov.com/government/departments/public-utilities/Documents/04_UraniumMiningReport_Final_Updated20110222_V2.pdf 	<ul style="list-style-type: none"> Moran, Robert E. 2011. <i>Site-Specific Assessment of the Proposed Uranium Mining and Milling Project at Coles Hill, Pittsylvania County, VA</i>. Michael-Moran Assoc., LLC.: Golden, CO. blog.rba.org/wp-content/uploads/2011/11/Report_Moran_Uranium_Coles-Hill.pdf 	<ul style="list-style-type: none"> Hazen and Sawyer, PC. & Tetra Tech, Inc. 2011. <i>Task Order No. 1 – Assessment of Potential Water Supply Impacts from Uranium Mining in Virginia</i>. Fairfax, VA. www.fcwa.org/current/FW%20Uranium%20Study.pdf