BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE

Historic and potential flooding at proposed uranium mine and mill site Coles Hill, Pittsylvania County, Virginia

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A Technical Report by the Blue Ridge Environmental Defense League

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September **26**, 2011

This report confirms that pervasive flooding regularly occurs throughout the proposed mine and mill site at Coles Hill, and demonstrates that flooding and other hydrological features at the site would increase the risk of radioactive contamination, should the site eventually be used to store uranium mill tailings.

Acknowledgements

In July, 2010, Blue Ridge Environmental Defense League (BREDL) became involved in the effort to prevent the lifting of Virginia's moratorium on uranium mining that has been in place since 1982. BREDL's involvement began when BREDL staff were contacted by Karen Maute, a Danville, Va.-based community organizer and publisher of a prolific email discussion group focusing on the environmental threats posed by uranium mining in Virginia and associated issues. Through Ms. Maute, we learned of a meeting being held on November 13, 2010 by the Roanoke River Basin Association (RRBA) featuring a tour of Virginia Uranium, Inc.'s proposed uranium mine and mill site at Coles Hill in Pittsylvania County.

BREDL staff attended the RRBA meeting and toured the proposed mine and mill site. The ñtake-homeò message of the tour was that the entire Coles Hill region currently planned for uranium mining and milling is frequently deluged by pervasive, heavy flooding from the many sizable streams which cross the area.

BREDL would like to acknowledge our indebtedness to Ms. Maute and RRBA for bringing the flooding issue to our attention and prompting the current investigation.

Finally, we would like to acknowledge the special contributions of George Stanhope, a member of Piedmont Residents in Defense of the Environment (PRIDE). Mr. Stanhope shared photographs he took of a flooding event at Coles Hill on November 11 and 12, 2009, and assisted BREDL in making GPS notations of sites throughout the Coles Hill area that had been deluged in the 2009 flood event.

During 2011, PRIDE, a chapter of BREDL with members in Danville, Coles Hill and nearby Pittsylvania County communities, and BREDL community organizers developed plans and strategies not only to keep the uranium mining ban in place, but to press for improved protection of the environment and public health. This report is part of our plan.

Flooding brings risk to uranium mill tailings containment

The most significant risk from uranium mining, such as that being proposed by Virginia Uranium, Inc. in Pittsylvania County, is that of radioactive contamination from the millions of tons of waste product created during the uranium milling process. These waste products, called ñtailings,ò remain radioactive for thousands of years and must be kept from getting into the air and water throughout that period. Tailings are typically stored at or near the mine site. In its recent promotional document, *The Coles Hill Progress* (summer, 2011), Virginia Uranium, Inc. (VUI) stated that it plans to store their uranium mine tailings near the Coles Hill mine site within the Whitethorn Creek watershed.

In the U.S., the job of managing these radioactive mill tailings is given to the Nuclear Regulatory Commission, under regulations written by the EPA, and often through an agreement with the state in which the mill is located. The land used for mill tailings disposal, as well as the tailings themselves, become the property of the United States or the state in which the land is located, imposing upon the federal or state government the financial responsibility for long-term surveillance and maintenance of the tailings.

In the interest of framing our discussion in terms set forth by universally-recognized experts on the subject of mill tailings containment, we have reproduced below eight excerpts from:

The long term stabilization of uranium mill tailings: Final report
International Atomic Energy Agency, August, 2004
www-pub.iaea.org/MTDC/publications/PDF/te_1403_web.pdf

The IAEA document established the necessity of isolating uranium mill tailings from water in the environment, whether that water takes the form of rain, streams, rivers, overland flooding, springs, or groundwater. In a very real sense, the single most critical issue identified in the IAEA study can be said to be the profundity of the challenges inherent in undertaking the isolation of uranium mill tailings from the aquatic environment for the tens of thousands of years during which the tailings remain radioactive.

As shown below, the IAEA report contradicts many industry assurances (and, in fact, contradicts a 2010 statement by the Director of the U.S. Dept. of Energy's Legacy Management program) that uranium mill tailing disposal sites are essentially maintenance free. What distinguishes the IAEA's perspective is its mindfulness of the difficulty of predicting performance of man-made structures, such as tailings containments, for a period lasting many thousands ï not just hundreds ï of years. IAEA states:

1. ñThe history of failure of tailings containments over the last 40-50 years shows that containment design and management themselves may not be enough to provide a high level of certainty that the tailings will remain properly isolated from the environment for indefinite

periods. This is particularly true when we consider that uranium mill tailings need to be effectively isolated for a long period to provide a high degree of certainty that the public and environment will not be negatively affected. The short duration of baseline and performance monitoring results in uncertainty in any long term predictions.ò

The following IAEA quotation references UMTRA, which stands for Uranium Mill Tailings Remediation Program. It is the US program focused specifically on remediation of uranium tailings piles accumulated at 22 sites mainly in the central western states.

2. ñThe design life of UMTRA [Uranium Mill Tailings Remediation Program] structures is 1000 years. However, satisfactory containment may be required for time-spans between one and two orders of magnitude greater than this [10,000 to 100,000 years] in order to guarantee effective isolation until levels of radioactivity have declined significantly.ò

The IAEA is unequivocal in stating that chronic releases of radioactive contamination continue to plague the uranium mining industry. VUI has recently declaimed the validity of a Virginia Beach-commissioned study citing threats of radioactive contamination of the Roanoke River Basin posed by potential releases from Coles Hill mill tailings containment during catastrophic storm events. What both the Virginia Beach study and VUI have neglected to consider is that chronic, not catastrophic, releases of radioactive contamination into the water are just as likely to pose a threat, given the very long time span under consideration. Says the IAEA,

3. ñNo catastrophic failures have been reported for purely uranium tailings impoundments for more than 20 years. On the other hand, chronic releases of radon, dust and contaminated water and the associated potential health impacts and environmental contamination are a concern at many sites around the world.ò

Estimating the true cost of opening up Virginia to uranium mining should include an estimate of the cost to federal or state government to conduct surveillance and maintenance of the uranium mill tailings storage site for tens of thousands of years. Here, it is helpful to add historical perspective. According to *The Timetables of History: A Horizontal Linkage of People and Events* (Grun, 1979), the year 4241 BC is the first exactly dated year in human history. 3500 BC marks the beginning of the rise of ancient Egypt, with its invention of the 360-day calendar containing 12 months, the first smelting of gold, the first use of numerals, and the beginning of systematic astronomical observations. By 800 BC the Egyptian empire had entered its 23rd dynasty, and the favorite royal sport at the time was hunting from chariots. Homer had penned the Greek epics, the *Iliad* and *Odyssey.* Comparing then with now, if the ancient Egyptian empire had filled their pyramids with uranium mill tailings, and if those tailings were released into the water or air today, they would still be capable of causing radioactive contamination. If our imaginary Egyptian forerunners had wanted to warn future generations about the risky tailings, by what means would their message have been transmitted? Hieroglyphics?

Considerations such as these point to the staggering length of time during which mill tailings retain their ability to cause radioactive contamination, and give good reason to consider the following quotation from the IAEA study with the utmost gravity:

4. ñThere is no such thing as 'fail-safe' facilities for tailings management. Neither regulations, design specifications, nor management systems can be relied upon in isolation to provide assurance against containment failure: all three must be applied, in a framework of quality assurance and post-closure care and maintenance, to deliver a high probability of tailings containment security. Examples exist of failure related to containments not being built as designed; regulators not checking that all requirements were provided for in construction and operation, and worst-case scenarios not being taken into consideration in deriving design specifications.ò

Flooding at Coles Hill

During any given year between the months of March and September, The National Weather Service will include Coles Hill among those Virginia communities under flood warning and flood watch. The four IAEA excerpts below consistently warn of the risk of radioactive contamination from uranium mill tailings through their contact with water:

5. ñClearly, water management is a critical issue for risk reduction. Dams can fail after closure, mainly as a result of earthquakes, geotechnical factors, and overland flooding.ò

6. ñThe placement of tailings below or under ground is likely to provide the best long term management solution from the point of view of both reducing potential liability, and providing the greatest long term environmental safety. However, the possibility of leaching and suffusion by permeating ground waters has to be considered.ò

7. ñIn relation to the general performance of uranium mill tailings containments, the main concerns relate to longevity of containment and seepage to groundwater . . .. Surface water flow may represent significantly higher risk of failure during the life of the containment.ò

8. Inadequate design and poor implementation can result in the failure of tailings covers. Possible causes of cover failure include . . . extreme weather events . . .. With recent extreme events of flooding in Europe and elsewhere, long-established design parameters, such as maximum rain intensities and rainfall-function for catchment areas have come under scrutiny.ò

In light of the IAEA's numerous caveats about risk of radioactive contamination brought by overland flooding and groundwater seepage at uranium mill tailings storage sites, BREDL has sought to substantiate the presence of flooding at Coles Hill. Below we offer maps providing evidence of (1) overland flooding and (2) hydrological features suggesting a high volume of underground water.

Both above- and below-ground features at Coles Hill suggest that any uranium mill tailings storage operation there would result in the high risk of chronic and/or catastrophic release of radioactive contamination into the aquatic environment.

The following features are discussed and mapped below:

- ✓ FEMA flood zones
- ✓ Historic floods on record with National Weather Service and recorded by local citizens
- ✓ Photographic evidence of pervasive flooding throughout the site
- ✓ A productive spring
- ✓ Wetlands.

FEMA flood zones and historic floods

The map in Attachment A illustrates that there are three individual FEMA flood hazard zones contained within the proposed Coles Hill uranium mine and mill site. These flood zones are aligned with three streams which flow through the Coles Hill site: Mill Creek, Whitethorn (alternately, Whitehorn) Creek, and the Banister River.

> Source: https://hazards.fema.gov/wps/portal/mapviewer. To display the flood zones, select ñZoom to Coordinates.ò Input Latitude 36.87, Longitude 79.3.)

Attachment A also shows four historic flood events that occurred at the Coles Hill site, as follows:

(1) September 29, 1999: Mill Creek flooded S. Meadows Rd., within perimeter of South Exploration Area.

> Source: National Weather Service. A copy of the source document is available at https://www.box.net/shared/btcvupzddsrnrfsuh9zd.

(2) September 30, 2010: Dry Branch and Mill Creek both flooded S. Meadows Rd., within perimeter of South Exploration Area.

> Source: National Weather Service. Copies of source documents are available at https://www.box.net/shared/btcvupzddsrnrfsuh9zd and https://www.box.net/shared/plikd54l0dxtm5mtosre.

(3) Hurricane Fran flood of 1996 captured on video 1.75 miles from boundary of South Exploration Area

> Source: We the People of Virginia (formerly Southside Concerned Citizens). Video is viewable online at http://www.youtube.com/user/sccchatham#p/a/u/1/F7mcUYAi_O4.

(4) November 12, 2009: Mill Creek flooded Coles Road; Dry Branch flooded S. Meadows Rd.

Source: date-stamped photographs courtesy of George Stanhope, PRIDE. Mr. Stanhope's photos appear in Attachment B, below.

Photographic evidence of pervasive flooding

On November 11 and 12, 2009, flooding occurred in the Coles Hill area that covered significant portions of both the North and South Exploration Areas in either standing or running water. See map with photos in Attachment B. The evidence of pervasive flooding throughout the Coles Hill site suggests there would be chronic or catastrophic failure of mill tailings containments, no matter where the containments may be sited within the Coles Hill mining area. Considering the IAEA's warning of ñuncertainty in any long-term predictionsò for the performance of mill tailing containment protocols even in the best of conditions, concerned citizens return again and again to the question: what assurance do we have of successful mill tailings containment for 100,000 years, or even 100 years, at Coles Hill, a site where flooding is both frequent and pervasive?

A spring and several acres of wetlands

Attachment C is a map showing the presence of a spring and several acres of wetlands located within the bounds of the Coles Hill South Exploration Area. The spring was identified by J. P. Gannon, in his 2009 report titled, ñHydrogeology at Coles Hill,ò prepared as part of his thesis for a Master of Science degree in Geosciences at Virginia Tech. The wetlands are a feature on the DeLorme TopoUSA8 topographic map (www.delorme.com), the electronic mapping system used on this project.

The presence of at least one spring and several acres of wetlands suggests the presence of a very high quantity of underground water at Coles Hill. The IAEA warns of the risk of ñleaching and suffusion by permeating ground watersò when uranium mill tailings are stored underground. The spring and wetlands, like the pervasive overland flooding, are indicators of an environment in which uranium mill tailings cannot be stored safely.

Conclusion

Above- and below-ground features at Coles Hill suggest that any uranium mill tailings storage operation there would create high risk of chronic and/or catastrophic release of radioactive contamination into the aquatic environment.

We close with the following questions and recommendations:

1. Has uranium mill tailings storage ever been attempted in an aquatic environment analogous to that of Coles Hill? Virginia Uranium, Inc. claims that it has, citing various examples and sending Virginia legislators to France and Canada to visit them. But a more systematic comparison of Coles Hill to past mill tailings containment sites is in order, to see what, if any, genuinely analogous sites exist from a hydrological perspective.

2. If analogous sites exist, what government funds have been spent to remediate the sites to make them safe for human use and habitation? How successful have those remediation projects been in eliminating radioactive contamination? The state should assess these costs.

3. If government funds have been spent to remediate any analogous sites, what guarantees exist that the U.S. federal government or Virginia treasury will contain sufficient funds to provide adequate monitoring and remediation to the Coles Hill site? Studies should consider time frames of 100 years, 1,000 years, and 100,000 years.

4. What would be the impact on the overall Pittsylvania County economy resulting from the public's perception of risk of radioactive contamination from long-term storage of uranium mill tailings at Coles Hill? Studies must address the socioeconomic impacts of uranium mining on the local economy resulting from the public's recognition of risk of radioactive contamination that lasts ï in every practical sense ï forever.

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