At the December 11, 2012 Uranium Mining Public Hearing in Chatham, Virginia, copies of the *Virginia Uranium Working Group Report,* November 30, 2012, were made available to the public. Of the 94 page Report, a little more than one-half a page is given to a section titled: "best managment practices." In order to learn more about the specifics of how uranium mining and milling would **actually** be operated and regulated, citizens have to read "Exhibit G: Engineering Design Best Management Practices Report" in the full *Uranium Study: Final Report Commonwealth of Virginia,* October 12, 2012. This section is 133 pages.

The following analysis of Exhibit G titled: **"Why 'Best Practices' Do Not Justify Lifting the Ban on Uranium Mining and Milling: A Response to *The Washington Post*" was sent to Virginia and North Carolina officials and the news media yesterday.**

TO: Virginia and North Carolina Legislators; Virginia Governor Bob McDonnell and North Carolina Governor-Elect Pat McCrory; and the Virginia, North Carolina, and National News Media

FROM: Deborah Ferruccio, Ken Ferruccio: Warren County, North Carolina,

SUBJECT: Why "Best Practices" Do Not Justify Lifting the Ban on Uranium Mining and Milling: A Response to *The Washington Post*

Introduction

On December 4, 2012, The Washington Post published its position regarding uranium mining in Virginia in an editorial titled "Uranium mining in Va. should proceed carefully," concluding "In the face of some inevitable uncertainty—but also plenty of experience from around the world from which to draw—lawmakers' best option is to lift the moratorium while ensuring all the caution mining advocates say they favor."

The failed fundamental prediction of the theoretical science of waste management concerning containment structures -- namely, that they can be engineered to prevent contamination -- was not addressed.

This prediction continues to be tested and proven false. Containment structures simply recycle waste back into the environment, contributing to the pervasive contamination of the planet. *The Washington Post* seems unaware that "best practices" is costing Cameco, the Canadian uranium mining company lobbying for mining in Virginia, a 1.2 billion dollar cleanup, so whatever revenues are promised from Virginia uranium mining, the real figures for taxpayers to consider are the billions that must be budgeted to pay for high-salaried staff, endless scientific and health studies, drawn-out litigation, bitterly fought-for cleanups, and compensation for irrevocable damages.

It should be of some interest to *The Washington Post* that North Carolinians cannot permit the storage of 120 million tons of radioactive waste near headwaters that flow into Kerr and Gaston Lakes, drinking water for hundreds of thousands of people and eventually for Raleigh and other nearby North Carolina municipalities.

If editors of the *The Washington Post* had read the 133 page " Exhibit G: Engineering Design Best Management Practices Report" in the full *Uranium Study: Final Report Commonwealth of Virginia,* October 12, 2012, they would have found that the engineering design for managing radioactive mine waste ("best practices") is similar to the engineering design for modern landfills. It is documented knowledge that landfills fail and contaminate the environment. In fact, EPA's online *Federal Register* states that all landfills leak (*Federal Register,* Feb. 5, 1981).

The following are more EPA statements concerning failure of landfills:

"Manmade permeable materials that might be used for liners or covers (e.g., membrane liners or other materials) are subject to eventual deterioration, and although this might not occur for 10, 20 or more years, it eventually occurs and, when it does, leachate will migrate out of the facility." [pg. 11128]

"Unfortunately, at the present time, it is not technologically and institutionally possible to contain wastes and constituents forever or for the long time periods that may be necessary to allow adequate degradation to be achieved." [pg. 11129]

"Consequently, the regulation of hazardous waste land disposal facilities must proceed from the assumption that migration of hazardous wastes and their constituents and by-products from a land disposal facility will inevitably occur." [pg. 11129]

"More than a year later, on July 26, 1982, the EPA again put its opinions into the *Federal Register,* emphasizing that all landfills will inevitably leak."

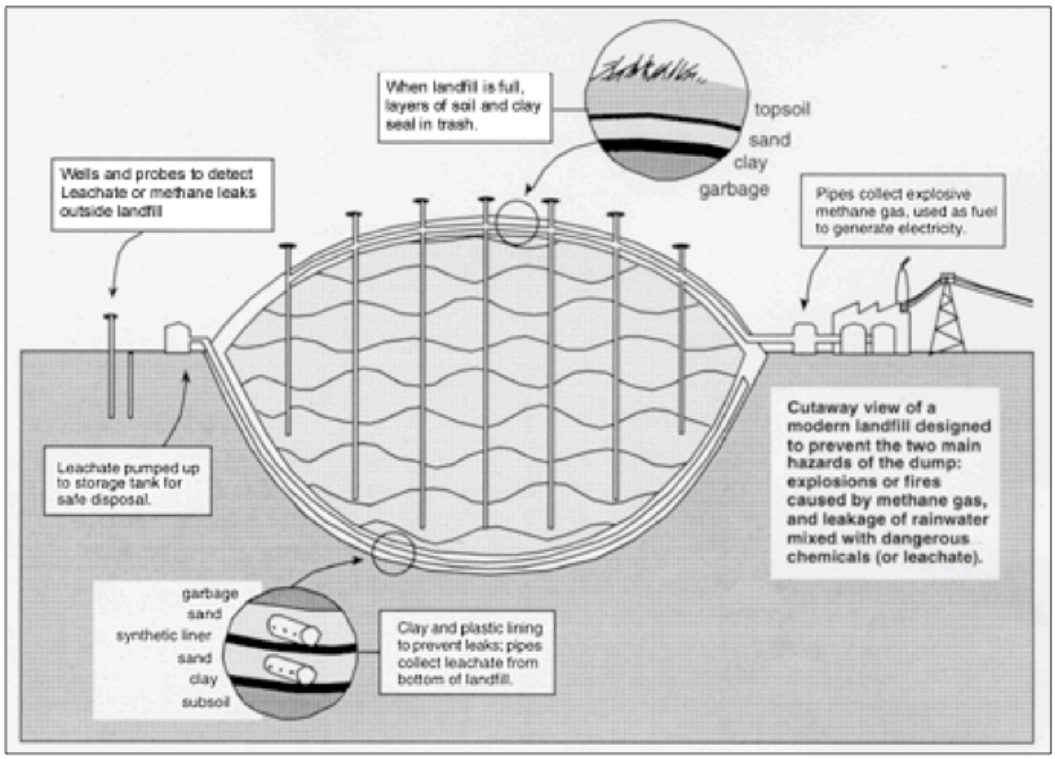
Similarities Between "Best Practices" Encapsulation Containment and Modern Landfill Containment Design

Because of the documented failed history of modern landfill design, the word "landfill" is negatively loaded in the minds of an educated public. To avoid the negative connotation of the word "landfill," the *Final Report* uses the phrase "encapsulation design."

The engineering designs and components are similar, but their purposes differ: Modern landfills (often called "dry tomb" landfills) are engineered to keep water out while encapsulation of radioactive mine waste may involve radioactive milled waste covered by water to mitigate dust. But landfill design is landfill design, whether called encapsulated "best practices" or "modern." All landfills fail in the short-term and long-term, but encapsulation landfills used for radioactive waste (tailings) would need to last hundreds of thousands of years.

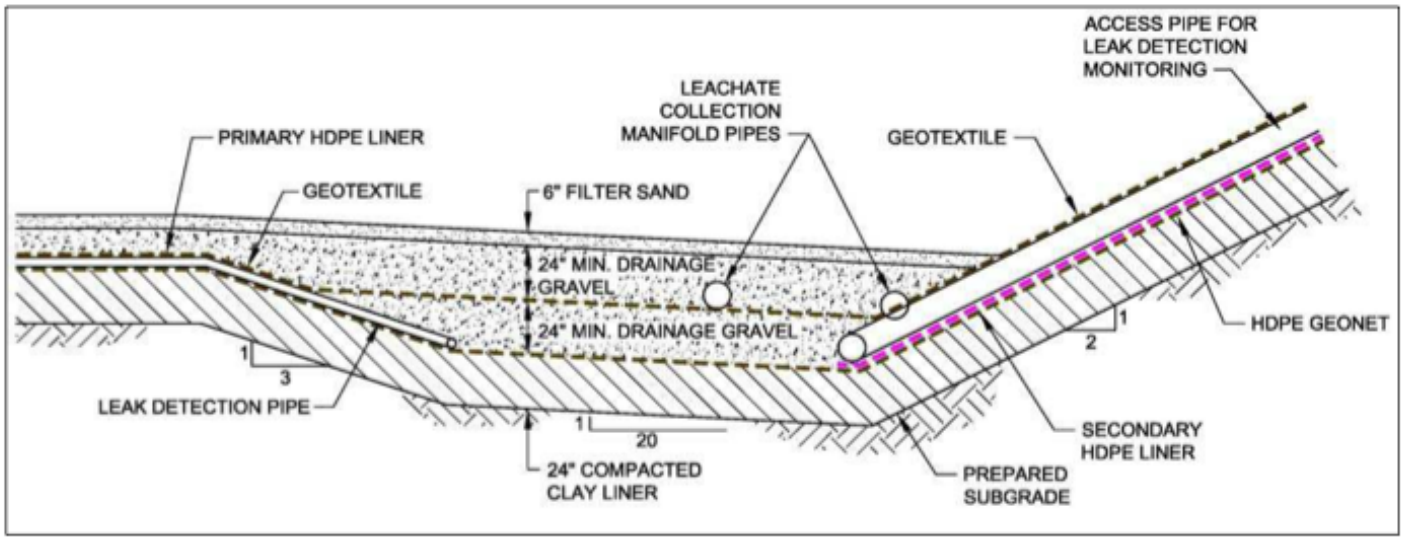
-----The following diagrams show that the modern landfill design and the "best practices" encapsulation design for mine tailings waste are similar:

Modern Landfill Design (epa.gov)



Similar Components of Encapsulation Containment and Landfill Containment Design

Encapsulation Design for Mine Tailings Waste: (*Final Report,* Exhibit G, Figure 3-2)



The components of the encapsulation design are the same as for modern landfills, including (1) plastic liners (2) clay liners compacted to meet EPA's maximum permeability criteria (1x10-7 cm/sec) (3) leachate collection systems (4) monitoring systems, and (5) covers. These components are addressed in Exhibit G of the *Final Report*.

1. Plastic liners: Why They Fail

The *Final Report* states that "the best liner systems constructed with good quality assurance / quality control measures still have allowable leakage rates" (3.4.6.Waste Containment Liners).

"In ensuring structural integrity, it must not be presumed that the liner system will function without leakage during the active life of the impoundment" (3.4.3 Engineering Controls). The many reasons why plastic liners fail are discussed in the *Final Report,* 3.5.2.2: Liner System Selection, Construction, and Protection, and the following describes some of these reasons:

"A composite liner is a single liner made of two parts, a plastic liner and compacted soil (usually clay soil). Reports show that all plastic liners (also called Flexible Membrane Liners, or FMLs) will have some leaks. It is important to realize that all materials used as liners are at least slightly permeable to liquids or gases and a certain amount of permeation through liners should be expected. Additional leakage results from defects such as cracks, holes, and faulty seams. Studies show that a 10-acre landfill will have a leak rate somewhere between 0.2 and 10 gallons per day (Environmental Research Foundation)".

Given that landfill liners all leak, the US EPA decided to base its Liner Actual Leakage Rate on "what can be achieved with current liner technology, rather than what is necessary to protect groundwater from pollution by landfill leachate (Lee and Jones-Lee, "Detection of the Failure of Landfill Liner Systems").

2. Clay liners: Why They Fail

Clay liners do not contain waste because the clay contains fractures and cracks. Also, "a mechanism called diffusion will move organic chemicals like benzene through a three-foot thick clay landfill liner in approximately five years. Some chemicals can degrade clay." (Environmental Research Foundation).

3. Leachate Collection Systems: Why They Fail

Contaminated water is called leachate which flows to the bottom of the containment empoundment and is then collected in a system of pipes. The water from the pipes is pumped to a wastewater treatment plant where the contaminated solids are removed, but often the leachate pipes become clogged; then water builds up, as in a bathtub, and "The resulting liquid pressure

becomes the main force driving waste out the bottom of the landfill when the bottom liner fails" (Environmental Research Foundation).

There are several known reasons why leachate collection systems can clog up in less than a decade: 1) they clog up from silt or mud; 2) they can clog up because of growth of microorganisms in the pipes; 3) they can clog up because of a chemical reaction leading to the precipitation of minerals in the pipes; or 4) the pipes become weakened by chemical attack (acids, solvents, oxidizing agents, or corrosion) and may then be crushed by the tons of garbage [waste] piled on them" (Environmental Research Foundation).

4. Monitoring: Why Monitoring of Groundwater and Air Emissions are Unreliable

Groundwater monitoring is unreliable. First, "There are no standards that indicate the number of groundwater monitoring wells that must be installed" (*Final Report,* Exhibit G: *3.4.2.2* Groundwater Monitoring).

There is a reason that there are no standards for the number of monitoring wells installed. According to waste management expert G. Fred Lee, groundwater monitoring wells can be spaced "hundreds to a thousand or more feet apart and still be in compliance." Also, monitoring wells can be deliberately placed in the least likely places to detect groundwater contamination. Consequently, monitoring wells often fail to detect groundwater contamination because the contaminated plumes flow between the wells and therefore are not detected before the contamination becomes widespread (Lee and Jones-Lee, "Detection of the Failure of Landfill Liner Systems").

In addition, what procedures could possibly assure the reliability of monitoring data, even if safe exposure levels could be known? For example,"The Texas Commission on Environmental Quality (TCEQ) spent two decades under-reporting radiation levels in local water supplies, which helped water districts avoid fines but which exposed residents to potentially harmful radioactive elements" ("Texas Environmental Commission manipulated test results to hide radiation in drinking water").

Air emissions from mine operations and milling are inevitable. According to the *Final Report*, "Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable (*Final Report:* 3.4.2.1: Air Monitoring*)*.

But what if the reduction of airborne effluent releases reduced to levels as "low as reasonably achievable" were not low enough to protect the public health and natural resources and could not be contained at the source? The *Final Report* states that " Institutional controls, such as extending the site boundary and exclusion area may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to control emissions at the source (*Final Report:* 3.4.2.: Air Monitoring).

In other words, given the inevitable failure of containment structures, the site boundary and exclusion area would need to be perpetually expanded so that airborne contamination would be in compliance with regulations.

5. Covers: Why they fail

Covers are vulnerable to destruction because of a number of sources, so radioactive and toxic contamination would escape. "1) Erosion by natural weathering (rain, hail, snow, freeze-thaw cycles, and wind); 2) Vegetation, such as shrubs and trees that continually compete with grasses for available space, sending down roots that will relentlessly seek to penetrate the cover; 3) Burrowing or soil-dwelling mammals (woodchucks, mice, moles, voles), reptiles (snakes, tortoises), insects (ants, beetles), and worms will present constant threats to the integrity of the cover; 4) Sunlight (if any of these other natural agents should succeed in uncovering a portion of the umbrella) will dry out clay (permitting cracks to develop), or destroy membrane liners through the action of ultraviolet radiation; 5) Subsidence--an uneven cave-in of the cap caused by settling of wastes or organic decay of wastes….can result in cracks in clay or tears in membrane liners, or result in ponding on the surface, which can make a clay cap mushy or can subject the cap to freeze-thaw pressures; ….and (7) Human activities of many kinds" (Environmental Research Foundation).

Engineering designs and components for containment structures do not prevent contamination. Regulations are written to legally authorize radiological exposures to such constituents as radon, the second leading cause of lung cancer, even though "no safe level of exposure is known" *[2012 Uranium Working Group Report* (*UWGR)*, p. 58]. According to the *UWGR* "Designs should include the 'As Low As Reasonably Achievable' (ALARA) concept to minimize exposure to mine workers and the environment" (p. 26). But such regulations are ill-advised in light of the fact that the health implications of even low diagnostic exposures to radiation for medical purposes are being reassessed.

There is, of course, an incentive to set the permissible maximum contaminant levels quite high in the regulations to ensure that contamination is in regulatory compliance, that the company's license to operate continues, and principal responsible parties are legally protected.

For example, although it was discovered that the low-level radioactive waste facility in Barnwell, South Carolina, was contaminating a nearby stream and the Savannah River and a judge stated that the situation was of "monumental significance," he nevertheless renewed the license because the situation was in compliance with regulations (The South Carolina Environmental Law Project.). Hence, regulations do not prevent contamination; they legally authorize and facilitate it.

Conclusion

The Washington Post has endorsed the delusional theoretical science of waste management concerning containment, which has become an ideology promoted and defended for vested interests instead of a theoretical science needing to be challenged in light of the continuous

failure of its fundamental prediction that containment structures can be engineered to keep solid, toxic, hazardous, and radioactive waste from contaminating the environment, health, and natural resources. *The Washington Post* has defended a model for economic development that is neither environmentally, democratically nor economically sustainable, a model that is pervasively contaminating the environment even as these words are being written.

Instead of supporting the public welfare and environmental protection, the paper's endorsement of uranium mining supports a handful of political and commercial interests looking for "yellow cake"gold that would provide ongoing high-paying jobs for an educated elite; increase political capital for a few, enhance investment portfolios, and expand global markets at the cost of a whole region of the South and beyond.

The above analysis of the Virginia Working Group's *Final Report* and supplemental information lead to the inescapable conclusion that the best practices regulatory framework for mining uranium and storing radioactive waste would consist of arbitrary and capricious procedures, policies, and standards based on a fallacy of containment. Cameco's present 1.2 billion dollar cleanup problem in Canada is yet another empirically demonstrated fact that containment facilities continue to fail. Therefore regulations are written to legally authorize radiological contamination to workers and to the environment because failure of the containment facilities is inevitable. Clearly, Virginia legislators must not lift the ban to mine uranium in Virginia.